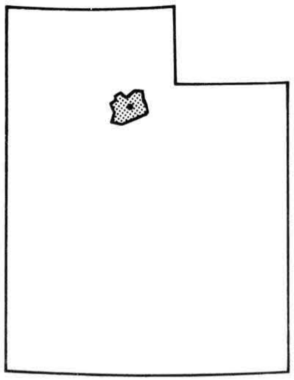
1994

Flood Insurance Study, City of Murray, Utah, Salt Lake County

Federal Emergency Management Agency

FLOOD INSURANCE STUDY



CITY OF MURRAY, UTAH
SALT LAKE COUNTY

REVISED: SEPTEMBER 30, 1994

Federal Emergency Management Agency

COMMUNITY NUMBER - 490103

NOTICE TO FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

Part or all of this Flood Insurance Study may be revised and republished at any time. In addition, part of this Flood Insurance Study may be revised by the Letter of Map Revision process, which does not involve republication or redistribution of the Flood Insurance Study. It is, therefore, the responsibility of the user to consult with community officials and to check the community repository to obtain the most current Flood Insurance Study components.

This publication incorporates revisions to the original Flood Insurance Study. These revisions are presented in Section 9.0.

This preliminary revised Flood Insurance Study contains only profiles added or revised as part of the restudy. All profiles will be included in the final published report.

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FLOOD INSURANCE STUDY

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Murray, Salt Lake County, Utah, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound flood plain management. Minimum flood plain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by Rollins, Brown and Gunnell, Inc., for the Federal Emergency Management Agency (FEMA), under Contract No. H-4593. The flood plain boundary delineations on Big Cottonwood Creek (downstream of Millrace Lane) were performed by Dames & Moore, for FEMA, under Contract No. C-0542. This study was completed in May 1982.

1.3 Coordination

Streams designated for detailed and approximate study were identified at a meeting attended by representatives of FEMA, the study contractor, Salt Lake County, and the communities therein in September 1977. Results of the hydrologic and hydraulic analyses were coordinated with representatives of the Salt Lake County Public Works Department, Flood Control and Water Quality Division; the U.S. Army Corps of Engineers; and the incorporated communities.

An intermediate coordination meeting was held on February 18, 1982, to allow community representatives to review the draft study. In attendance were representatives of FEMA, the study contractor, the U.S. Army Corps of Engineers, Salt Lake County, and the Cities of South Salt Lake, Murray, Midvale, and West Valley City. Representatives of the City of Murray pointed out several locations on Big Cottonwood and Little Cottonwood Creeks where U.S. Army Corps of Engineers field data did not reflect recent channel changes. These changes were incorporated into this study.

A final community coordination meeting for Salt Lake County and the Cities of Draper, Murray, Sandy City, and South Salt Lake was held on December 14, 1983. In attendance were representatives of FEMA, the study contractor, the county, and the incorporated communities. Two major concerns raised at the meeting were that the studies did not reflect flows from the 1983 flood and the conversion of the detailed study reaches of the Jordan River between 2100 South Street and the North Jordan Canal Diversion Dam to approximate study. It was agreed that these problems would be addressed during the appeals period along with other minor concerns raised by the individual communities and the county. All requests were considered and, where appropriate, were acted upon in the preparation of this study.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated areas of the City of Murray, Salt Lake County, Utah. The area of study is shown on the Vicinity Map (Figure 1).

Unincorporated areas of Salt Lake County located within the community were excluded from the study.

The Jordan River, Big Cottonwood Creek, and Little Cottonwood Creek were selected for study by detailed methods within the community.

The detailed-study reach of the Jordan River within Murray was converted to approximate study. This change resulted from uncertainties in frequency analysis of the hydrologic data and from uncertainties in hydraulic modeling caused by completed and ongoing modifications to the river channel initiated after the completion date of this study. In addition, problems were encountered with elevation data on the orthophoto topographic maps used for the detailed flood boundary delineations; there were also discrepancies between the results of the step-backwater analysis and the detailed flood boundary delineations. Appproximate flood boundaries were taken from Flood Hazard Boundary Maps (Reference 1 and 2) and were supplemented by U.S. Army Corps of Engineers Flood Plain Information reports (References 3 and 4) where Flood Hazard Boundary Map coverage was not complete.

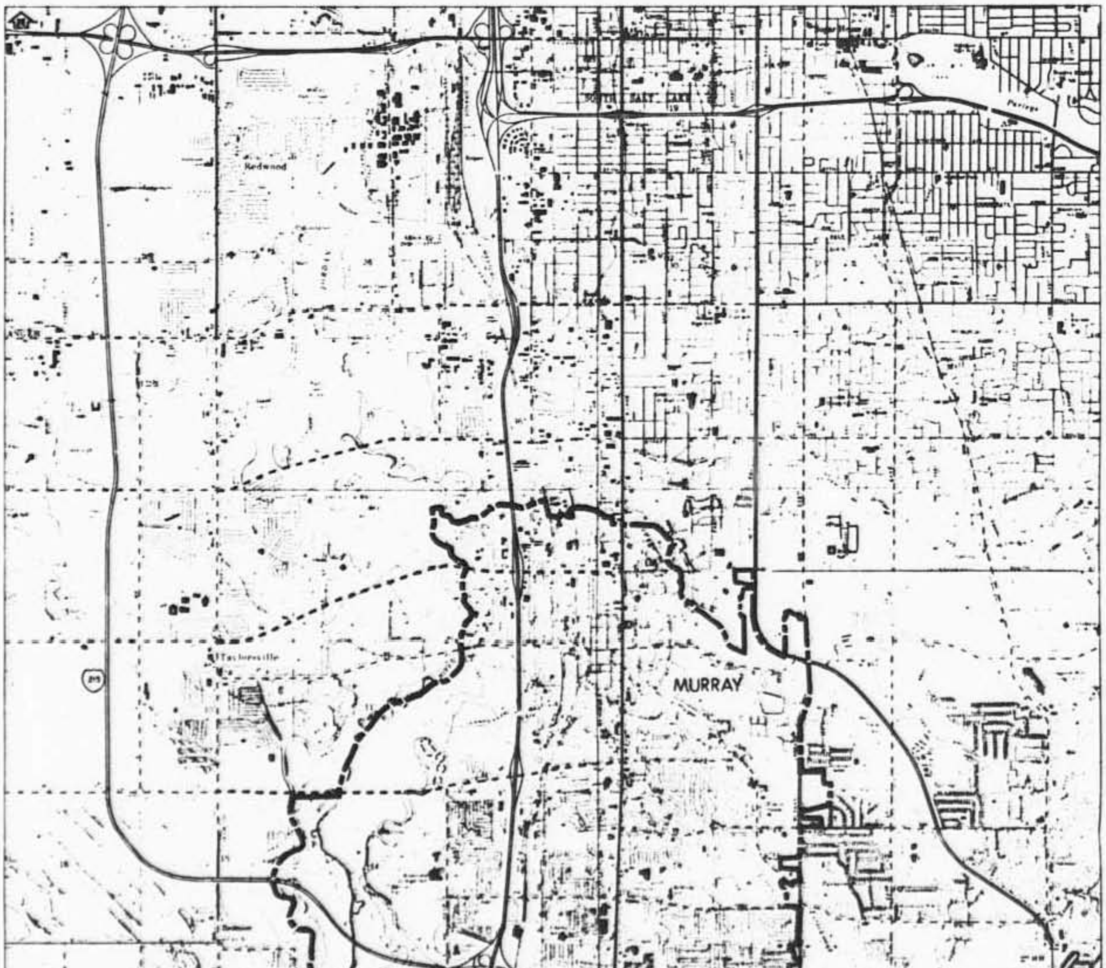

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MURRAY, UT
(SALT LAKE CO.)

APPROXIMATE SCALE

4000 0 4000 8000 12000 FEET

VICINITY MAP

3

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through 1987.

2.2 Community Description

Murray is located in central Salt Lake County, in north-central Utah. Murray is bordered by the City of Midvale on the south and unincorporated areas of Salt Lake County on the west, north, and east.

Most of the residential development in Murray has occurred in the terrace area east of the Jordan River. Substantial amounts of commercial and industrial development have occurred along U.S. Highway 89-91 and Interstate Highway 15, which traverse the Salt Lake Valley from north to south.

Residential, commercial, and industrial development has occurred extensively in the flood plains of Big and Little Cottonwood Creeks. The flood plain of the Jordan River is largely undeveloped; however, there are a few residences, some agricultural development, and two sewage disposal facilities in this area.

The Salt Lake Valley lies between the Oquirrh Mountains on the west and the Wasatch Mountains on the east. The valley extends from the Traverse Mountains on the south to the Great Salt Lake on the north. The principal stream in the Salt Lake Valley is the Jordan River. It originates in Utah Lake at an elevation of approximately 4,489 feet and flows northerly approximately 40 miles through the center of the valley to terminate in the Great Salt Lake. The eastside stream tributaries to the Jordan River originate in the high elevations of the Wasatch Mountains. These streams emerge at the foothill line and flow westerly across terraces formed by the recession of prehistoric Lake Bonneville. Big Cottonwood and Little Cottonwood Creeks are perennial tributary streams that drain the center portion of the Wasatch Mountains on the eastern side of the valley. These eastside streams have fairly steep gradients as they cross the terraces, but become quite flat as they reach the valley floor. Drainage areas of the tributaries to the Jordan River range from the high areas of the Wasatch Mountains at an elevation of more than 11,000 feet to the valley floor at an elevation of 4,250 feet.

Soils typically found in the terraces are granular, while the valley floor is primarily composed of clays or clayey gravels.

Vegetation ranges from conifer, aspen, and oak in the higher mountain elevations to scrub oak, sage, and underbrush in the lower mountain elevations. Residential valley areas are vegetated mainly with lawn grasses, ornamental shrubbery, and shade trees. Undeveloped valley areas are mostly covered by grasses and sagebrush. Aspen and cottonwood trees grow along the streams.

The Salt Lake Valley has a temperate, semiarid climate with four distinguishable seasons. Temperatures generally range from -20°F in the winter to 105°F in the summer. Precipitation tends to vary directly with elevation, from 16 inches annually on the valley floor to 40 inches annually in the high mountains (Reference 5).

2.3 Principal Flood Problems

Flooding in the Salt Lake Valley generally occurs due to snowmelt runoff, cloudburst rainstorms, and general rainstorms. Snowmelt floods usually occur in April, May, and June. Cloudburst rainstorms are high-intensity, short-duration storms that usually occur over a relatively small area. These storms are characterized by high runoff peaks, but low volumes. They generally occur from June through October. General rainstorms are caused by low-intensity, long-duration rainfall. These storms can have a higher peak than the snowmelt flood and can often have a higher volume than the cloudburst events. General rainstorms can occur at any time during the year.

Flooding from all of these types of events has occurred in Salt Lake County; however, the most dramatic and extensive flooding has been due to snowmelt and cloudburst floods.

The most notable flood on record occurred in April and May 1952. This flood was caused by the rapid melting of an unusually large snowpack in the Wasatch Mountains. Details of this and other major flooding events are shown in Table 1.

Streamflow gages on the eastside tributary streams are generally located at the canyon mouths. These gages, therefore, give an accurate measurement of snowmelt runoff, but do not include any indication of runoff associated with cloudburst rainfall on the urbanized area.

2.4 Flood Protection Measures

Utah Lake, at the head of the Jordan River, affords a reduction of floodflows along the Jordan River above 2100 South Street (located north of Murray). This lake is a natural water body that has been artificially modified so that the water-surface elevation can be controlled through the use of several large radial gates and a pumping station. The ability to raise and lower the lake elevation caused conflicts between the water users and the property owners adjacent to the lake. To resolve the conflicts in 1885, a "compromise level" elevation of 4,489.34 feet was agreed upon. Whenever runoff forecasts indicate that the water surface will exceed the compromise level, the lake is drawn down to permit discharges comparable to natural conditions.

Table 1. Recorded Floods at Stream Gages

Year	Stream	Flow (cfs)[1]	Estimated Return Interval (Years)
1909	Big Cottonwood Creek[2]	835	67
1912	Big Cottonwood Creek[2]	848	77
	Little Cottonwood Creek[3]	705	13
1921	Big Cottonwood Creek[2]	721	30
	Little Cottonwood Creek[3]	762	18
	Jordan River[4]	1,020	20
1952	Big Cottonwood Creek[2]	503	4
	Little Cottonwood Creek[3]	597	5
	Jordan River[4]	1,410	50
1953	Big Cottonwood Creek[2]	503	4
	Little Cottonwood Creek[3]	736	15

[1] Flow values shown are mean daily. Instantaneous peaks would be somewhat higher.
[2] At Canyon Mouth - Salt Lake City stream gage No. 10168500
[3] At Canyon Mouth - Salt Lake City stream gage No. 10167500
[4] At Jordan Narrows - U.S. Geological Survey stream gage No. 10167000

A number of irrigation diversions along the Jordan River near the southern boundary of Salt Lake County, such as Turner Dam at Jordan Narrows, can substantially reduce floodflows. Most outflow from Utah Lake, except during periods of high flow such as the 100- and 500-year floods, can be diverted to these canals. A detention basin has been constructed on Big Cottonwood Creek near Highland Drive, located upstream of Murray. Discharge from this basin is limited to approximately 650 cubic feet per second (cfs). This tends to reduce 100- and 500-year discharges in Murray.

Salt Lake County officials have established a Flood Control and Water Quality Division in their Public Works Department. It is the responsibility of this office to manage and enforce the county development and flood control ordinances in the unincorporated areas. The department also works with the incorporated communities within the county, as requested, to manage and review flood-control projects. Salt Lake County also has a countywide flood-control tax that enables it to obtain tax funds for use in construction of new flood-control projects and maintenance of existing facilities.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

Several stream gages have been operated on the Salt Lake County streams since the beginning of the century by Salt Lake City and the U.S. Geological Survey (References 6 and 7). A summary of the various gages, their locations, lengths of record, and operating agencies is shown in Table 2.

Floodflow-frequency analyses for the snowmelt events were performed for Big Cottonwood and Little Cottonwood Creeks. The peak flow values were computed based on U.S. Water Resources Council guidelines for determining floodflow frequencies (Reference 8). This method uses existing streamflow data and log-Pearson Type III distribution in conjunction with a regional skew to predict floodflows. Streamflow records dating back to 1898 were used in the analysis.

Existing streamflow information is not adequate to predict cloudburst runoff values downstream of the canyon mouths, where flows depend on inflow from the urban area. To obtain flow values in these areas, the U.S. Army Corps of Engineers HEC-1 computer runoff model was used (Reference 9). This model uses a kinematic wave calculation to produce runoff due to rainfall. The model computes and routes flows based on physical characteristics of the basin (such as percent imperviousness, infiltration rates, basin area, and slope) and storm characteristics (such as precipitation depths and rainfall distribution and duration). Rainfall depths were obtained from Precipitation-Frequency Atlas of the Western United States, Volume VI, prepared by the National Oceanic and Atmospheric Administration (Reference 10). Because of the lack of available rainfall-runoff data, it was not possible to calibrate the computer model.

The results of the log-Pearson Type III analyses were combined with the results of the HEC-1 analyses. Snowmelt events, with long, sustained peak discharges, dominated upstream of canyon mouths and cloudburst events, with short, intense peak discharges, dominated downstream of canyon mouths.

The hydrologic analyses described above for Big Cottonwood and Little Cottonwood Creeks were performed by the U.S. Army Corps of Engineers as part of Jordan River Investigation, Utah (Reference 11).

Peak discharge-drainage area relationships for Big Cottonwood and Little Cottonwood Creeks are shown in Table 3.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Water-surface elevations of floods of the selected recurrence intervals for the detailed study streams were computed using the

Table 2. Stream Gages - Jordan River, Big Cottonwood Creek, and Little Cottonwood Creek

Stream and Location	Gage Number	Operating Agency	Years of Record
Jordan River			
At Narrows Near Lehi	10167000	U.S. Geological Survey	1913 - Present
At 9400 South Street	10167200	U.S. Geological Survey	1965 - 1968
Big Cottonwood Creek			
At Canyon Mouth	10168500	Salt Lake City[1]	1898 - Present[2]
At Cottonwood Lane	10168800	U.S. Geological Survey	1964 - 1968, 1979 - Present
At 200 West Street	10169500	U.S. Geological Survey	1933 - 1935, 1979 - Present
Little Cottonwood Creek			
At Canyon Mouth	10167500	Salt Lake City[1]	1898 - Present[2]
At 2050 East Street	10167700	U.S. Geological Survey	1963 - Present
At 200 West Street	10168000	U.S. Geological Survey	1933 - 1934, 1980 - Present

[1]Portions of Salt Lake City's daily records and monthly summaries of all records have been published by the U.S. Geological Survey.
[2]Records are intermittent, 1898-1913.

Table 3. Summary of Discharges

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (Cubic Feet per Second) 10-Year	50-Year	100-Year	500-Year
Big Cottonwood Creek					
At 1300 East Street (Upstream of Murray)	63	700[1]	813[1]	891[1]	1,349[1]
At 4500 South Street	66	968[1]	1,272[1]	1,514[1]	3,639[1]
At Union Pacific Railroad	77	961[1]	1,248[1]	1,458[1]	3,294[1]
At 300 West Street	78	944[1]	1,201[1]	1,349[1]	2,684[1]
Little Cottonwood Creek					
At 1300 East Street (Upstream of Murray)	38	690[1]	915[1]	1,055[1]	3,950[1]
At 5900 South Street	43	740[1]	910[1]	990[1]	2,070[1]
At 5600 South Street	44	710[1]	840[1]	910[1]	2,510[1]
At Union Pacific Railroad	46	680[1]	770[1]	810[1]	1,250[1]
Jordan River					
Narrows	2,755	1,260	2,400	3,000	4,800
9000 South Street	2,905	1,170	2,230	2,790	4,465
5800 South Street	2,985	1,200	2,280	2,850	4,560
Little Cottonwood Creek Confluence	--[2]	1,585	3,010	3,740	5,925
Big Cottonwood Creek Confluence	--[2]	1,930	3,665	4,535	7,145
Mill Creek Confluence	--[2]	2,000	3,800	4,700	7,400
2100 South Street	3,165[3]	2,000	3,800	4,700	7,400

[1] Discharge reductions are due to overbank storage (generally, a result of constriction in the floodplain) and/or losses to shallow overbank flows.
[2] Data not available
[3] Value estimated based on published drainage area for gage at 1700 South Street

U.S. Army Corps of Engineers HEC-2 step-backwater computer program (Reference 12). Flood profiles for the selected recurrence intervals were drawn showing the computed water-surface elevation.

Channel roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and based on field observations of the streams and flood plain areas. Roughness values ranged from 0.025 to 0.200 for main channels and from 0.030 to 0.240 for overbank areas.

The hydraulic analyses for Big Cottonwood and Little Cottonwood Creeks were performed by the U.S. Army Corps of Engineers as part of the Jordan River Investigation report (Reference 11).

Cross section data for Big Cottonwood and Little Cottonwood Creeks were developed by the U.S. Army Corps of Engineers for Jordan River Investigation, Utah (Reference 11). These cross sections were taken from orthophoto-topographic maps at a scale of 1:600, with a contour interval of 2 feet (Reference 13). Supplemental cross sections to define new bridges or changes in topography were measured as a part of this Flood Insurance Study. All bridges, dams, and culverts were field checked to obtain information to describe their structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Starting water-surface elevations for all streams were determined by normal-depth calculations.

Upstream of Murray, 500-year flooding leaves Little Cottonwood Creek at Fort Union Boulevard (7000 South Street) and flows northward, generally paralleling the stream channel. In the vicinity of 900 East Street just upstream of the city, this flow is joined by 100-year and additional 500-year overflows from Little Cottonwood Creek. These overland flows move northwesterly until they flow into Big Cottonwood Creek in the vicinity of Shamrock Drive in Murray. On the basis of field inspection, review of topographic data, and engineering judgment, the U.S. Army Corps of Engineers determined these flows to average less than 1 foot in depth (Reference 11).

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study produces maps designed to assist communities in developing flood plain management measures.

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for flood plain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year flood plain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using the topographic and orthophoto-topographic maps described below.

For Big Cottonwood Creek downstream from Millrace Lane, flood plain boundaries were delineated on topographic maps at a scale of 1:24,000, with contour intervals of 5, 10, and 40 feet (Reference 14). For Big Cottonwood Creek upstream from Millrace Lane, boundaries were delineated on orthophoto-topographic maps at a scale of 1:2,400, with contour intervals of 2.5 and 5 feet (Reference 15). Flood plain boundaries for Little Cottonwood Creek were delineated on orthophoto-topographic maps at a scale of 1:2,400, with contour intervals of 2 and 4 feet (Reference 16).

Flood plain boundary delineations for Big Cottonwood Creek upstream of Millrace Lane and Little Cottonwood Creek were delineated by the U.S. Army Corps of Engineers for Jordan River Investigation, Utah (Reference 11).

The 100- and 500-year flood plain boundaries are shown on the Flood Boundary and Floodway Map (Exhibit 2). In cases where the 100- and 500-year flood plain boundaries are close together, only the 100-year flood plain boundary has been shown. Small areas within the flood plain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

Approximate flood plain boundaries for the Jordan River were taken from Flood Hazard Boundary Maps (References 1 and 2). These approximate boundaries were supplemented by boundaries taken from Flood

Plain Information reports produced by the U.S. Army Corps of Engineers (References 3 and 4).

4.2 Floodways

Encroachment on flood plai ., such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood plain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed on the basis of equal-conveyance reduction from each side of the flood plain. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 4).

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway boundaries were computed at cross sections. Between cross sections, the boundaries were interpolated. In cases where the floodway and 100-year flood plain boundaries are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and 100-year flood plain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET NGVD)
Big Cottonwood Creek								
A	135	110	418	3.1	4,243.0[3]	4,241.9	4,241.9	0.0
B	1,080	57	320	4.0	4,243.0[3]	4,242.9	4,243.7	0.8
C	1,670	53	373	3.5	4,243.7	4,243.7	4,244.7	1.0
D	2,373	93	547	2.4	4,244.4	4,244.4	4,245.3	0.9
E	2,478	19	192	7.0	4,246.0	4,246.0	4,246.0	0.0
F	3,260	68	519	2.6	4,246.8	4,246.8	4,247.3	0.5
G	3,520	50	286	4.7	4,246.9	4,246.9	4,247.5	0.6
H	3,560	172	1,122	1.2	4,247.4	4,247.4	4,247.9	0.5
I	3,975	90	593	2.3	4,247.5	4,247.5	4,248.0	0.5
J	4,160	32/0[2]	255	5.6	4,247.5	4,247.5	4,248.1	0.6
K	4,523	50/20[2]	406	3.5	4,248.4	4,248.4	4,248.9	0.5
L	4,623	17/0[2]	160	8.9	4,248.4	4,248.4	4,248.9	0.5
M	6,100	36/18[2]	271	5.4	4,252.5	4,252.5	4,253.1	0.6
N	6,805	65/33[2]	466	3.3	4,253.7	4,253.7	4,254.4	0.7
O	6,813	66/30[2]	464	3.3	4,253.7	4,253.7	4,254.7	1.0
P	6,903	77/35[2]	589	2.6	4,254.0	4,254.0	4,254.9	0.9
Q	7,300	30/20[2]	235	6.5	4,254.0	4,254.0	4,255.0	1.0
R	7,765	49/20[2]	352	4.3	4,256.0	4,256.0	4,256.7	0.7
S	7,886	19/10[2]	188	8.0	4,256.4	4,256.4	4,256.9	0.5
T	8,230	68/55[2]	466	3.3	4,257.9	4,257.9	4,258.3	0.4
U	9,500	322/105[2]	1,717	0.9	4,260.4	4,260.4	4,261.0	0.6
V	10,100	152	821	1.9	4,260.5	4,260.5	4,261.1	0.6
W	10,690	45	254	6.1	4,260.7	4,260.7	4,261.4	0.7
X	10,842	329	1,231	1.2	4,263.9	4,263.9	4,263.9	0.0
Y	11,500	165/45[2]	508	3.0	4,264.1	4,264.1	4,264.1	0.0
Z	11,864	146/20[2]	523	2.9	4,264.4	4,264.4	4,264.8	0.4

[1] Feet Above Mouth
[2] Width/Width Within Corporate Limits
[3] Backwater Effects from Jordan River

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TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MURRAY, UT

(SALT LAKE CO.)

FLOODWAY DATA

BIG COTTONWOOD CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Big Cottonwood Creek (Cont'd)								
AA	12,064	20/10[2]	219	7.0	4,268.9	4,268.9	4,268.9	0.0
AB	12,104	208/175[2]	1,171	1.3	4,270.5	4,270.5	4,270.5	0.0
AC	12,800	267/195[2]	1,454	1.1	4,270.6	4,270.6	4,270.6	0.0
AD	13,500	76/45[2]	427	2.9	4,270.6	4,270.6	4,270.6	0.0
AE	14,300	65/40[2]	268	4.3	4,271.2	4,271.2	4,271.2	0.0
AF	15,050	59/20[2]	290	3.7	4,272.9	4,272.9	4,273.4	0.5
AG	15,800	39/20[2]	174	6.2	4,274.8	4,274.8	4,275.7	0.9
AH	16,548	19	120	7.7	4,279.0	4,279.0	4,280.0	1.0
AI	17,200	41	122	7.6	4,281.5	4,281.5	4,282.0	0.5
AJ	17,774	41	216	4.3	4,285.6	4,285.6	4,285.9	0.3
AK	18,014	28	163	5.6	4,285.8	4,285.8	4,286.8	1.0
AL	18,500	31	137	6.6	4,288.4	4,288.4	4,288.5	0.1

[1]Feet Above Mouth [2]Width/Width Within Corporate Limits

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MURRAY, UT
(SALT LAKE CO.)

FLOODWAY DATA

BIG COTTONWOOD CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY	INCREASE
Little Cottonwood Creek								
A	700	61	333	2.4	4,252.6	4,252.6	4,252.7	0.1
B	1,120	62	329	1.9	4,252.8	4,252.8	4,252.9	0.1
C	1,590	109	436	1.8	4,252.9	4,252.9	4,253.0	0.1
D	2,265	27	157	5.1	4,253.8	4,253.8	4,254.8	1.0
E	2,950	16	70	11.5	4,257.5	4,257.5	4,257.5	0.0
F	3,160	46	181	4.6	4,260.1	4,260.1	4,260.1	0.0
G	3,650	66	254	3.2	4,260.6	4,260.6	4,261.2	0.6
H	3,940	10	89	9.2	4,266.4	4,266.4	4,266.4	0.0
I	4,270	55	360	2.3	4,267.9	4,267.9	4,267.9	0.0
J	4,740	21	165	5.1	4,269.9	4,269.9	4,270.9	1.0
K	4,920	35	182	4.7	4,270.4	4,270.4	4,271.1	0.7
L	5,270	16	72	11.9	4,271.6	4,271.6	4,271.6	0.0
M	5,320	52	174	4.9	4,271.6	4,271.6	4,271.6	0.0
N	6,060	35	169	5.1	4,273.6	4,273.6	4,273.6	0.0
O	6,280	38	181	4.8	4,274.2	4,274.2	4,274.2	0.0
P	6,550	41	160	5.4	4,275.0	4,275.0	4,275.0	0.0
Q	6,750	16	129	6.7	4,277.3	4,277.3	4,277.3	0.0
R	6,880	105	478	1.8	4,278.1	4,278.1	4,278.1	0.0
S	7,400	29	157	5.6	4,278.3	4,278.3	4,278.3	0.0
T	7,800	28	148	5.9	4,278.7	4,278.7	4,279.6	0.9
U	8,460	72	253	3.4	4,280.6	4,280.6	4,281.6	1.0
V	8,770	20	106	8.2	4,282.3	4,282.3	4,283.2	0.9
W	8,900	29	152	5.8	4,284.2	4,284.2	4,284.4	0.2
X	9,600	48	199	4.4	4,287.0	4,287.0	4,287.1	0.1
Y	10,400	36	95	9.3	4,291.4	4,291.4	4,291.4	0.0
Z	10,560	19	105	8.4	4,294.4	4,294.4	4,294.4	0.0

[1]Feet Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MURRAY, UT
(SALT LAKE CO.)

FLOODWAY DATA

LITTLE COTTONWOOD CREEK

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET NGVD)
Little Cottonwood Creek (Cont'd)								
AA	10,650	26	113	7.8	4,295.4	4,295.4	4,295.4	0.0
AB	10,940	77	298	3.0	4,296.8	4,296.8	4,297.0	0.2
AC	11,310	20	142	6.2	4,297.9	4,297.9	4,297.9	0.0
AD	11,730	22	139	6.5	4,298.7	4,298.7	4,299.0	0.3
AE	11,860	59	261	3.5	4,299.5	4,299.5	4,299.8	0.3
AF	12,050	22	122	7.4	4,299.8	4,299.8	4,300.1	0.3
AG	12,350	27	108	8.4	4,302.2	4,302.2	4,302.2	0.0
AH	12,480	21	132	6.8	4,303.5	4,303.5	4,303.5	0.0
AI	12,910	93	227	4.0	4,306.3	4,306.3	4,306.3	0.0
AJ	13,210	18	96	9.3	4,307.9	4,307.9	4,307.9	0.0
AK	13,720	51	166	5.4	4,310.7	4,310.7	4,310.9	0.2
AL	13,850	19	100	9.0	4,311.4	4,311.4	4,311.5	0.1
AM	14,140	49	269	3.4	4,314.7	4,314.7	4,314.7	0.0
AN	14,730	40	101	9.0	4,315.6	4,315.6	4,315.6	0.0
AO	15,310	61	236	3.9	4,321.7	4,321.7	4,321.8	0.1
AP	16,050	57	178	5.1	4,327.6	4,327.6	4,327.6	0.0
AQ	16,950	17	101	9.0	4,334.9	4,334.9	4,335.4	0.5
AR	17,280	67	216	4.2	4,338.0	4,338.0	4,338.2	0.2
AS	17,800	51	172	5.3	4,340.4	4,340.4	4,340.7	0.3
AT	18,300	78	214	4.3	4,344.3	4,344.3	4,345.0	0.7
AU	18,800	55	189	4.8	4,348.7	4,348.7	4,349.3	0.6

[1]Feet Above Mouth

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TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MURRAY, UT
(SALT LAKE CO.)

FLOODWAY DATA

LITTLE COTTONWOOD CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Jordan River								
A	23,569	72	860	5.3	4,242.1	4,242.1	4,243.1	1.0
B	23,884	185	1,240	3.7	4,242.8	4,242.8	4,243.5	0.7
C	25,079	243	1,611	2.3	4,243.4	4,243.4	4,244.4	1.0
D	25,609	100	993	3.8	4,243.6	4,243.6	4,244.6	1.0
E	26,599	86	873	4.3	4,244.3	4,244.3	4,245.2	0.9
F	27,230	145	816	4.6	4,245.1	4,245.1	4,246.0	0.9
G	27,830	76	832	4.5	4,245.7	4,245.7	4,246.7	1.0
H	28,005	83	582	6.4	4,246.6	4,246.5	4,246.9	0.4
I	29,035	61	434	8.6	4,247.7	4,247.7	4,248.0	0.3
J	29,595	44	614	6.1	4,249.1	4,249.1	4,249.5	0.4
K	30,042	41	526	7.1	4,249.2	4,249.2	4,249.7	0.5
L	30,752	89	728	3.9	4,250.1	4,250.1	4,250.8	0.7
M	31,112	142	844	3.4	4,250.1	4,250.1	4,250.8	0.7
N	32,462	124	714	4.0	4,250.8	4,250.8	4,251.7	0.9
O	32,797	54	402	7.1	4,250.9	4,250.9	4,251.7	0.8
P	33,407	71	578	4.9	4,251.7	4,251.7	4,252.6	0.9
Q	34,447	90	623	4.6	4,252.5	4,252.5	4,253.4	0.9
R	35,787	85	585	4.9	4,253.7	4,253.7	4,254.3	0.6
S	36,277	95	550	5.2	4,254.3	4,254.3	4,254.8	0.5
T	37,057	120	673	4.2	4,255.6	4,255.6	4,255.9	0.3
U	37,349	52	436	6.5	4,256.5	4,256.5	4,256.7	0.2
V	37,939	101	658	4.3	4,257.7	4,257.7	4,258.0	0.3
W	38,449	51	467	6.1	4,258.1	4,258.1	4,258.4	0.3
X	39,099	106	695	4.1	4,259.3	4,259.3	4,260.1	0.8
Y	39,549	57	454	6.3	4,260.1	4,260.1	4,260.8	0.7
Z	40,069	65	557	5.1	4,261.4	4,261.4	4,262.1	0.7

[1]Feet Above Surplus Canal Diversion

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TABLE 4	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF MURRAY, UT (SALT LAKE CO.)	FLOODWAY DATA 18 JORDAN RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Jordan River (Cont'd)								
AA	40,439	88	773	3.7	4,262.0	4,262.0	4,262.7	0.7
AB	41,021	81	700	4.0	4,263.1	4,263.1	4,264.1	1.0
AC	41,791	86	593	4.7	4,263.9	4,263.9	4,264.7	0.8
AD	42,701	89	520	5.4	4,265.0	4,265.0	4,265.6	0.6
AE	43,315	57	469	5.9	4,266.1	4,266.1	4,266.6	0.5
AF	43,465	93	549	5.1	4,266.4	4,266.4	4,266.9	0.5
AG	43,965	98	646	4.3	4,267.1	4,267.1	4,267.5	0.4
AH	44,445	107	594	4.7	4,267.3	4,267.3	4,267.7	0.4
AI	45,035	84	508	5.5	4,267.9	4,267.9	4,268.2	0.3
AJ	45,835	61	445	6.3	4,269.5	4,269.5	4,269.9	0.4
AK	46,185	65	571	4.9	4,270.2	4,270.2	4,270.7	0.5
AL	46,455	50	490	5.7	4,275.4	4,275.4	4,275.4	0.0
AM	47,205	80	514	5.4	4,275.6	4,275.6	4,275.6	0.0

[1]Feet Above Surplus Canal Diversion

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TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MURRAY, UT

(SALT LAKE CO.)

FLOODWAY DATA

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JORDAN RIVER

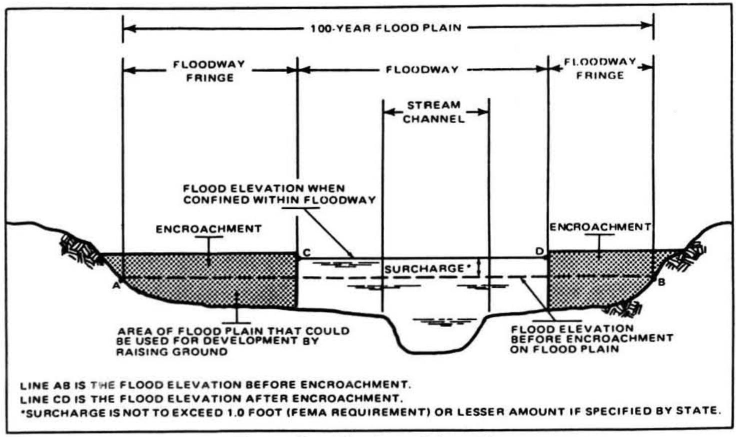

Figure 2. Floodway Schematic

5.0 INSURANCE APPLICATION

To establish actuarial insurance rates, data from the engineering study must be transformed into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source studied in detail affecting the City of Murray, Salt Lake County, Utah.

5.1 Reach Determinations

Reaches are defined as sections of flood plain that have relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference may not have a variation greater than that indicated in the following table for more than 20 percent of the reach:

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

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5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is used to establish relationships between depth and frequency of flooding in any reach. This relationship is then used with depth-damage relationships for various classes of structures to establish actuarial insurance rate tables.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations rounded to the nearest one-half foot, multiplied by 10, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, it is rounded to the nearest whole foot.

5.3 Flood Insurance Zones

Flood insurance zones and zone numbers are assigned based on the type of flood hazard and the FHF, respectively. A unique zone number is associated with each possible FHF, and varies from 1 for a FHF of 005 to a maximum of 30 for a FHF of 200 or greater.

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined.
Zones A1, A2, and A4:	Special Flood Hazard Areas inundated by the 100-year flood; with base flood elevations shown, and zones subdivided according to FHFs.
Zone B:	Areas between the Special Flood Hazard Areas and the limits of the 500-year flood; areas that are protected from the 100- or 500-year floods by dike, levee, or other local water-control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flood hazard; not subdivided.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of Murray is, for insurance purposes, the principal product of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevations. Base flood elevation lines show the locations of the expected whole-foot water-surface elevation of the base (100-year) flood. The base flood elevations and zone numbers are used by insurance agents, in conjunction with structure elevations and characteristics, to assign actuarial insurance rates to structures and contents insured under the NFIP.

6.0 OTHER STUDIES

The Flood Insurance Study for the unincorporated areas of Salt Lake County (Reference 17) is in agreement with this study. A Flood Hazard Boundary Map for the City of Midvale (Reference 18) is also in agreement with this study.

A Flood Hazard Boundary Map for the City of Murray has been published (Reference 1). This map was used as the source of approximate flood plain boundaries for the Jordan River in this study. However, in areas studied by detailed methods, this study represents a more recent and comprehensive analysis and therefore supersedes the Flood Hazard Boundary map. A Flood Hazard Boundary Map prepared for Salt Lake County (Reference 2) was also used as a source of approximate flooding on Jordan River in areas not covered by the map for the City of Murray.

A Flood Plain Information report by the U.S. Army Corps of Engineers for the lower Jordan River and its tributaries (Reference 3) included analyses of Big Cottonwood and Little Cottonwood Creeks. Because of different values used for parameters such as infiltration rates and permeability and different hydrologic methodologies, the discharges used for these streams in this study are generally lower than those given in the Flood Plain Information report. Additionally, there are differences between this study and the report due to revised hydraulic analyses and the use of more recent and detailed topographic mapping. The 100-year flood plain boundaries for the Jordan River from this report and another Flood Plain Information report produced by the U.S. Army Corps of Engineers in 1974 (Reference 4) were used to supplement approximate flood plain boundaries in areas not covered by the Flood Hazard Boundary Maps for the area (References 1 and 2).

A report by the U.S. Army Corps of Engineers, entitled Jordan River Investigation, Utah (Reference 11), was the source of hydrologic and hydraulic analyses for Big Cottonwood and Little Cottonwood Creeks. The

100- and 500-year flood plain boundaries developed for this report were also used in this study for Big Cottonwood Creek upstream of Millrace Lane and for Little Cottonwood Creek.

A recent report prepared by the U.S. Army Corps of Engineers (Reference 19) reevaluated the frequency of flood discharges along Mill, Big Cottonwood, and Little Cottonwood Creeks. This report considered the impacts of the extreme flood of September 1983 and of recent urban development. The U.S. Army Corps of Engineers report indicates that discharges along these three streams, in general, are larger than those used in this study; however, they are not significantly larger statistically. Changes have occurred along the stream channels since the September 1983 flood and additional changes are ongoing or planned. An assessment of the preciseness of discharge rates and the reliability of available hydraulic channel information suggests that future flood hazards along Mill, Big Cottonwood, and Little Cottonwood Creeks are defined in this study within the range of currently attainable reliability.

Following the disastrous flooding along Utah Lake and the Jordan River in 1983 and 1984, Salt Lake County and Utah County officials commissioned an investigation by CH2M HILL, Inc., of remedial measures to mitigate future flood losses. The resulting report (Reference 20) proposed channel modifications on the Jordan River, a flow control structure for Utah Lake, and a plan for regulating Utah Lake outflows. These proposals were based on design discharge values established through an analysis of historical Jordan River and tributary floodflow records a synthesis of impacts of controlled releases from Utah Lake. These design discharges are shown in Table 5. The design discharges were used in a hydraulic step-backwater model (Reference 12) of the Jordan River which assumed all proposed channel modifications to be in place. This analysis resulted in a water-surface profile shown in this Flood Insurance Study as the Utah Lake/Jordan River Flood Management Plan Profiles. No comparison or correlation between these profiles and the data presented in this study can be made or is intended. Most of the Jordan River channel modifications and the Utah Lake outflow control structure have not been completed. The proposed plan for regulating outflows from Utah Lake is not being used at present.

This study is authoritative for the purposes of the NFIP; data presented herein either supersede or are compatible with all previous determinations.

7.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, Building 710, Denver Federal Center, Lakewood, Colorado 80225.

Table 5. Jordan River Proposed Design Discharges

Location	Design Discharge (cfs)[1]
2100 South Street to Mill Creek Confluence	4,500
Mill Creek Confluence to Big Cottonwood Creek Confluence	4,500
Big Cottonwood Creek Confluence to Little Cottonwood Creek Confluence	4,380
Little Cottonwood Creek Confluence to 5800 South Street (Bullion Street)	3,870
5800 South Street (Bullion Street) to 9400 South Street	3,330

[1]Source of Discharge Data: Utah Lake/Jordan River Flood Management Plan, Phase I Report (Reference 20)

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9.0 REVISION DESCRIPTIONS

This section has been added to provide information regarding significant revisions made since the original Flood Insurance Study was printed. Future revisions may be made that do not result in the republishing of the Flood Insurance Study report. To assure that any user is aware of all revisions, it is advisable to contact the community repository of flood hazard data located at the Salt Lake County Department of Public Works, Flood Control and Highway Division, 20001 South State Street, Number N3300, Salt Lake City, Utah 84190-4600.

9.1 First Revision

This study was revised on September 30, 1994, to include the restudy of the Jordan River conducted for FEMA by CH2M Hill under Contract No. EMW-90-C-3104. The restudy was completed in November 1992.

The Jordan River was studied in detail from the Utah - Salt Lake County line to the Surplus Canal diversion near 2100 South Street. The study area includes portions of the unincorporated areas of Salt Lake County, as well as portions of the Cities of West Valley, South Salt Lake, Murray, Midvale, West Jordan, South Jordan, Sandy, Riverton, Draper, Bluffdale, and Salt Lake City.

Hydrologic analyses were performed to establish discharge-frequency relationships at four locations in the study reach of the Jordan River. Historic streamflow data were analyzed in accordance with criteria outlined in Bulletin No. 17B, Guidelines for Determining Flood Flow Frequency (Reference 21).

Historic Utah Lake stage records beginning in 1884, and a high water reference of 1862, were used in conjunction with a stage-discharge curve to estimate historic natural discharges in the Jordan River. These data were used to supplement the U.S. Geological Survey (USGS) streamflow data to develop the discharge-frequency curves. The locations, length of record, and operating agency, and type of record available for the streamflow gages used for his study are summarized in Table 2.

The streamflow gaging records for the Jordan River consist of two data populations as a result of the operational effects of the Compromise Agreement: natural releases and pumped releases (Reference 22). The two data populations were analyzed independently to develop flood flow frequency curves for snowmelt events, as it was determined that floods caused by snowmelt events are generally more severe than those caused by rainfall events. Flood peaks caused by rainfall events were not evaluated with peaks caused by snowmelt events so that the data populations would be homogeneous. The most severe snowmelt floods on the Jordan River are associated with natural releases and high levels of Utah Lake.

Discharge contributions to the Jordan River from Mill Creek, Big Cottonwood Creek, and Little Cottonwood Creek were based on estimated 100-year tributary discharges at the canyon mouths developed by the U.S. Army Corps of Engineers (USACE) (Reference 19).

The peak discharge-drainage area relationships developed for the Jordan River were added to Table 3.

The HEC-2 computer model developed by the study contractor as part of the Utah Lake/Jordan River Flood Management Program in 1984 was used as a basis for performing the hydraulic analyses of the Jordan River (Reference 20). The cross sections used to develop that model were field surveyed in June 1984 during the peak flow period. That model was calibrated to the 1984 event. To update the model developed in 1984, 78 additional cross sections were added to the 1984 model. Cross section data for approximately 38 of the supplemental cross sections were obtained from a 1987 survey where monumented cross sections were established between 2100 South and 14600 South to monitor erosion and deposition. The data for the remaining 40 cross sections were field surveyed in 1990 and 1991. Overbank and underwater data were obtained by field survey for all channel cross sections. In some areas (i.e., between 2100 South and the Mill Creek confluence) supplemental overbank cross section data were obtained from the 1990 orthophoto topographic maps provided by Salt Lake County (Reference 23). The portion of the HEC-2 model for the study reach upstream of Turner Dam was obtained from data developed by the USACE. All hydraulic structures were surveyed to obtain elevation and structural geometry data.

Water-surface elevations for floods of the selected recurrence intervals were computed using the HEC-2 Water Surface Profiles computer program developed by the USACE (Reference 24). Starting water-surface elevations were determined using the slope-area method.

Natural channel and overbank roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and based on field observations and of the stream and floodplain areas. Roughness values ranged from 0.022 to 0.077 for the natural main channel and from 0.075 to 0.225 for overbank areas. Main channel roughness coefficients of 0.012 and 0.013 were used to model flow through two of the concrete diversion structures on the river.

Orthophoto topographic maps with a scale of 1:4,800 and a contour interval of 4 feet, with 2-foot supplemental contours, were provided to the study contractor by Salt Lake County (Reference 23). The photograph date of the study area was November 11, 1990.

Five shallow flooding or ponding zones (Zone AH) are identified on the maps. One of these areas is located just downstream of the Big Cottonwood Creek confluence. Another is located just upstream of the 4500 South Street bridge. The other three are located between the south side of the Sharon Steel tailings pile and the North Jordan Diversion structure.

The AH Zone located just downstream of the Big Cottonwood Creek confluence is located in a low area behind a short levee. This levee is not a FEMA certified levee, it provides less than 3 feet of freeboard during the 100-year flood, and shallow flooding occasionally occurs in the area because of inadequate internal drainage facilities. The flood elevation in this area was assumed to be equal to the water-surface elevation in the Jordan River.

The other four AH Zones are shallow flooding areas in low overbank areas along the Jordan River. The flood elevations in those areas were estimated from the water surface in the river at the low points where water enters those areas.

Flood boundaries for the Jordan River were delineated using orthophoto topographic maps at a scale of 1:4,800 with a contour interval of 4 feet and supplemental 2-foot contours. The contours on these maps extend to a point that is either 1,000 feet from the channel or 10 feet above the top of the bank, whichever comes first. In areas where the floodplain exceeded contoured areas on the maps, USGS quadrangle maps were used to supplement the contours on the orthophoto topographic maps (Reference 25). In the west overbank area between 2100 South Street and the Decker Lake Drain, the orthophoto topographic map contour data were supplemented with contour data from 1985 orthophoto topographic mapping with a contour interval of 5 feet provided by West Valley City (Reference 26).

The Summary of Discharges Table and Floodway Data Table were revised to include data for the Jordan River, and Flood Profiles for the Jordan River were added. In addition, Flood Profile Panel 01P and the Floodway Data Table for Big Cottonwood Creek were revised to show the backwater effects from the Jordan River. Flood Profile Panel 15P and the Floodway Data Table for Little Cottonwood Creek were revised to add flooding information added due to corporate limits changes.

As a part of this update, the Utah Lake/Jordan River Flood Management Plan Profiles (Jordan River) have been removed from this report.

Also, as a part of this update, the Flood Insurance Rate Map for the City of Murray was converted to the Map Initiatives format. In the Map Initiatives Format, all base flood elevations, cross sections, and floodplain and floodway boundaries are shown on the

Flood Insurance Rate Map. The Flood Insurance Zone Designations were changed to reflect the Map Initiatives format as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

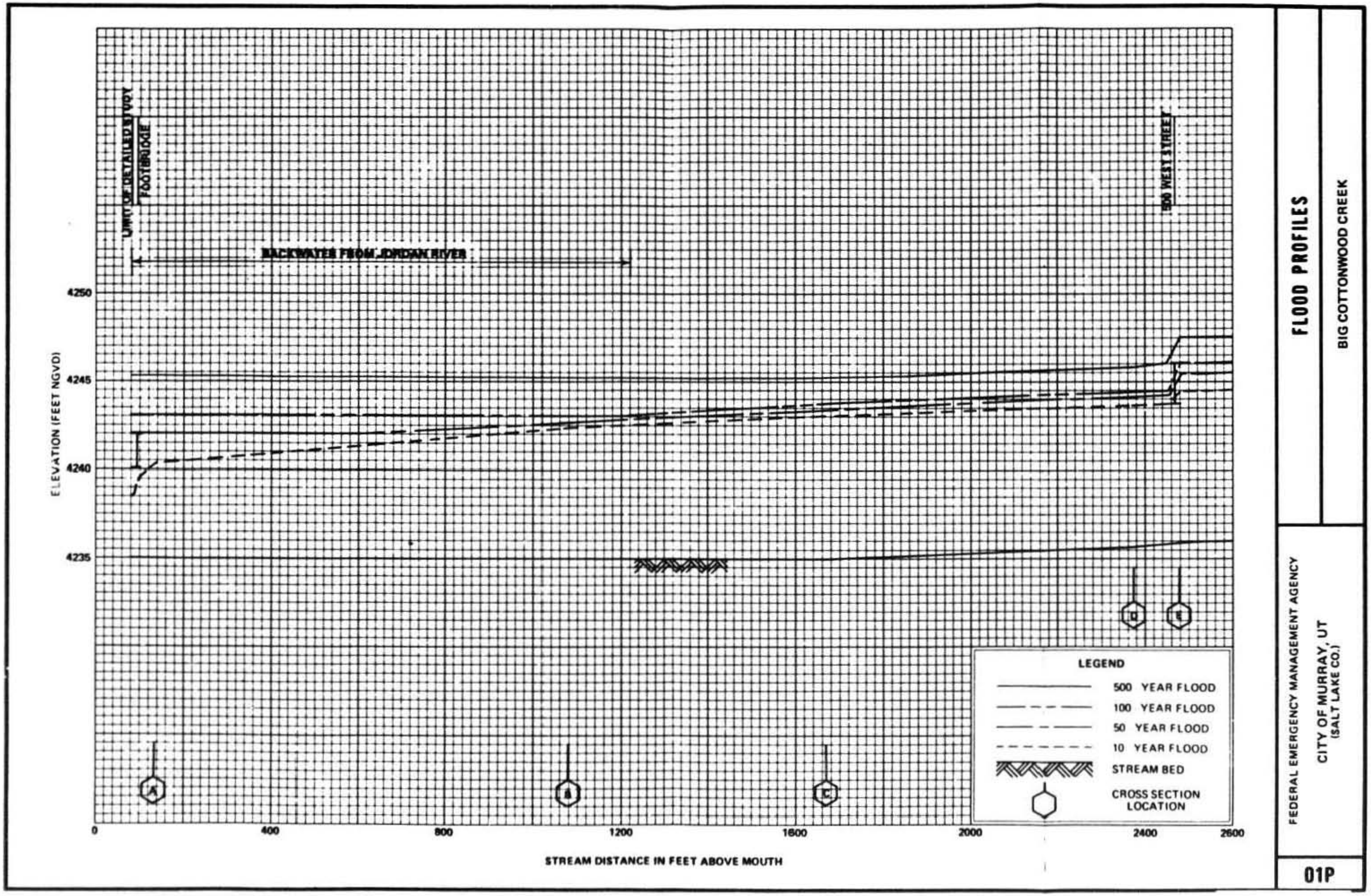
Zone AH

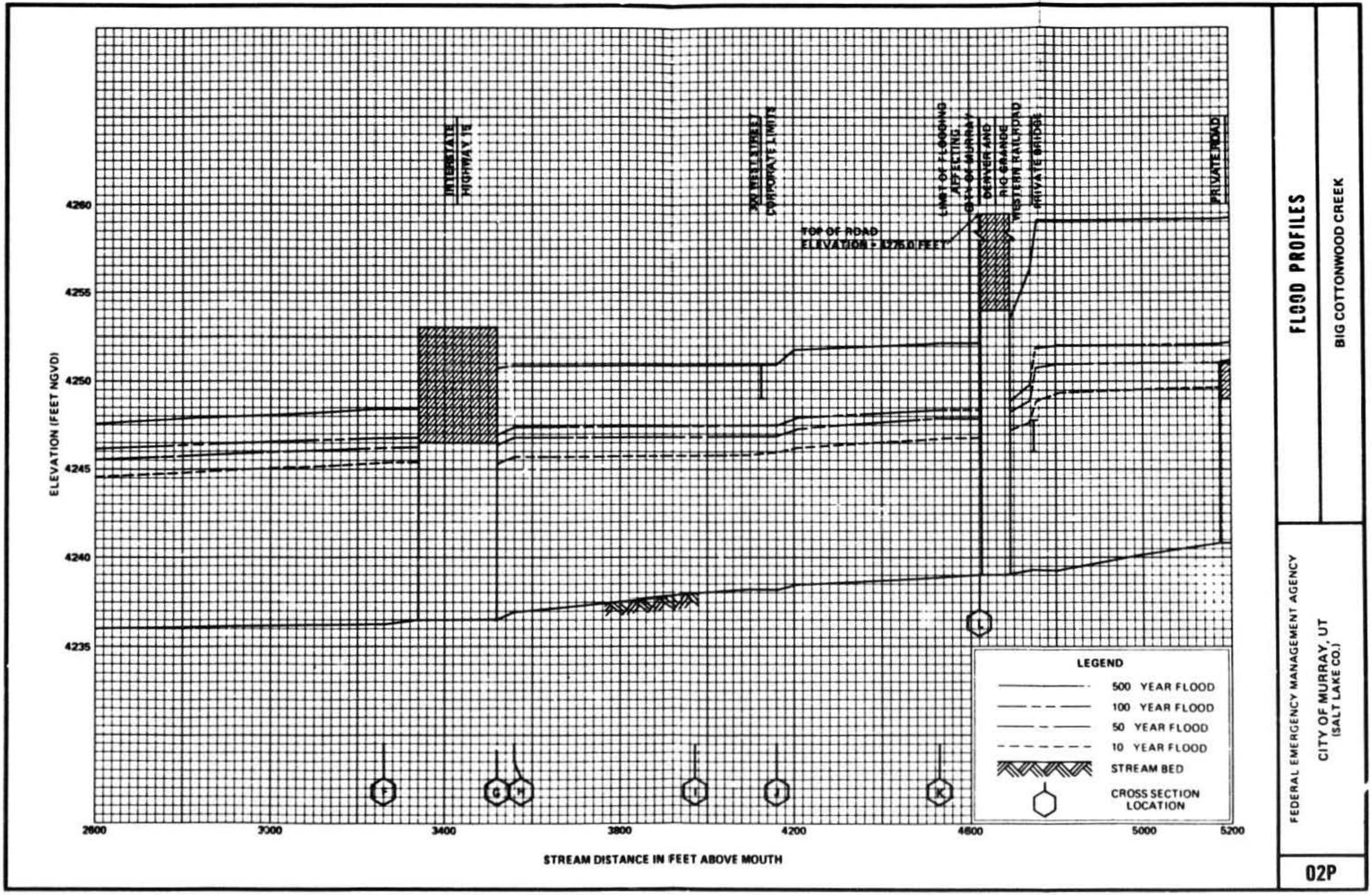
Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

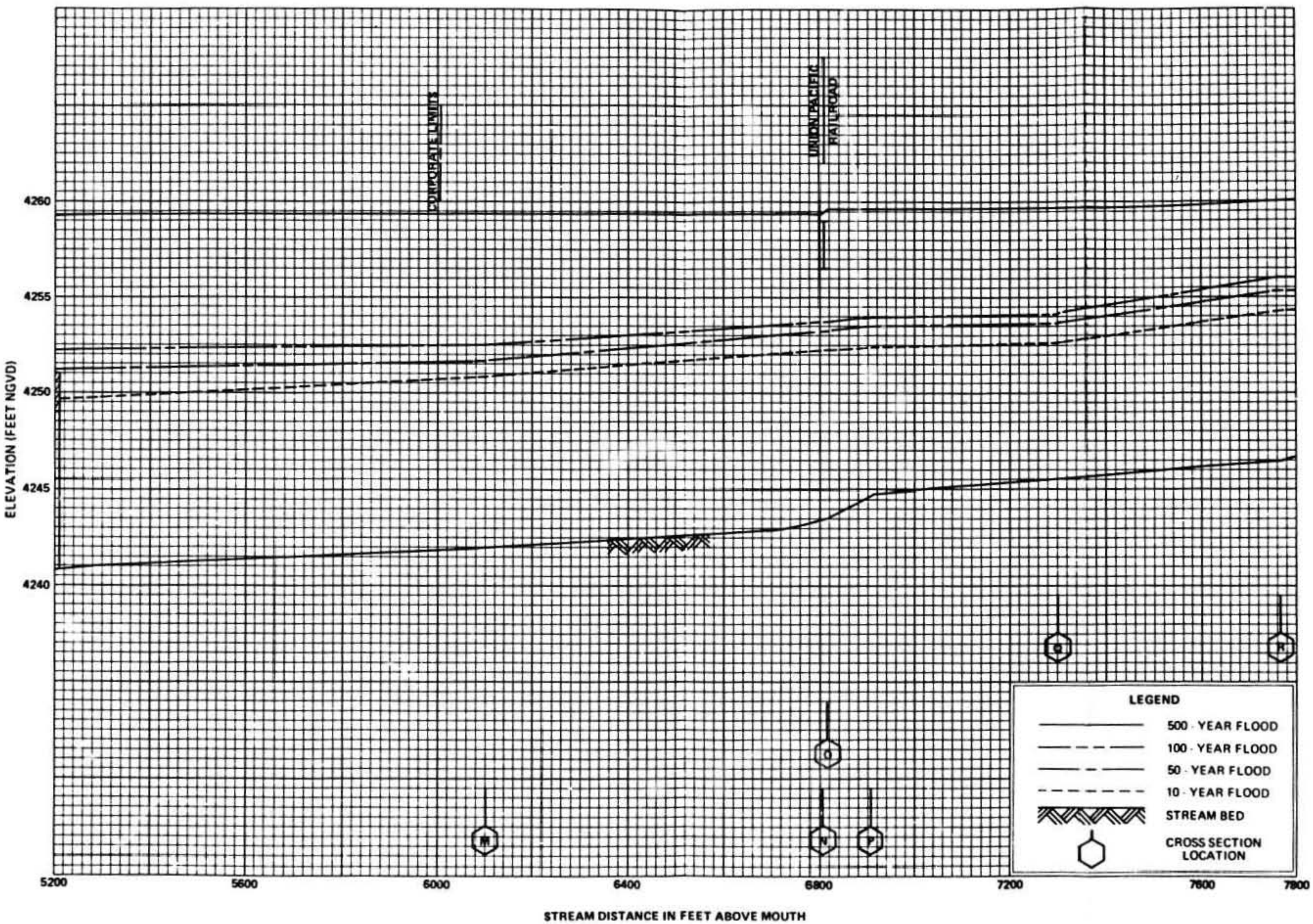
Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

In addition, the Flood Insurance Zone Data Table was removed from the Flood Insurance Study report, and all zone designations and reach determinations were removed from the profiles.


LIMIT OF DETAILED STUDY
FOOTBRIDGE
500 WEST STREET
BACKWATER FROM JORDAN RIVER
ELEVATION (FEET NGVD)
4250
4245
4240
4235
A
B
C
D
E
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
STREAM BED
CROSS SECTION LOCATION
0
400
800
1200
1600
2000
2400
2600
STREAM DISTANCE IN FEET ABOVE MOUTH
FLOOD PROFILES
BIG COTTONWOOD CREEK
FEDERAL EMERGENCY MANAGEMENT AGENCY
CITY OF MURRAY, UT
(SALT LAKE CO.)
01P



INTERSTATE HIGHWAY 15
300 WEST STREET CORPORATE LIMITS
LIMIT OF FLOODING AFFECTING CITY OF MURRAY
DENVER AND RIO GRANDE WESTERN RAILROAD
PRIVATE BRIDGE
PRIVATE ROAD
TOP OF ROAD ELEVATION = 4275.0 FEET
ELEVATION (FEET NGVD)
4260
4255
4250
4245
4240
4235
2600
3000
3400
3800
4200
4600
5000
5200
STREAM DISTANCE IN FEET ABOVE MOUTH
F
G
H
I
J
K
L
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
STREAM BED
CROSS SECTION LOCATION
FLOOD PROFILES
BIG COTTONWOOD CREEK
FEDERAL EMERGENCY MANAGEMENT AGENCY
CITY OF MURRAY, UT
(SALT LAKE CO.)
02P



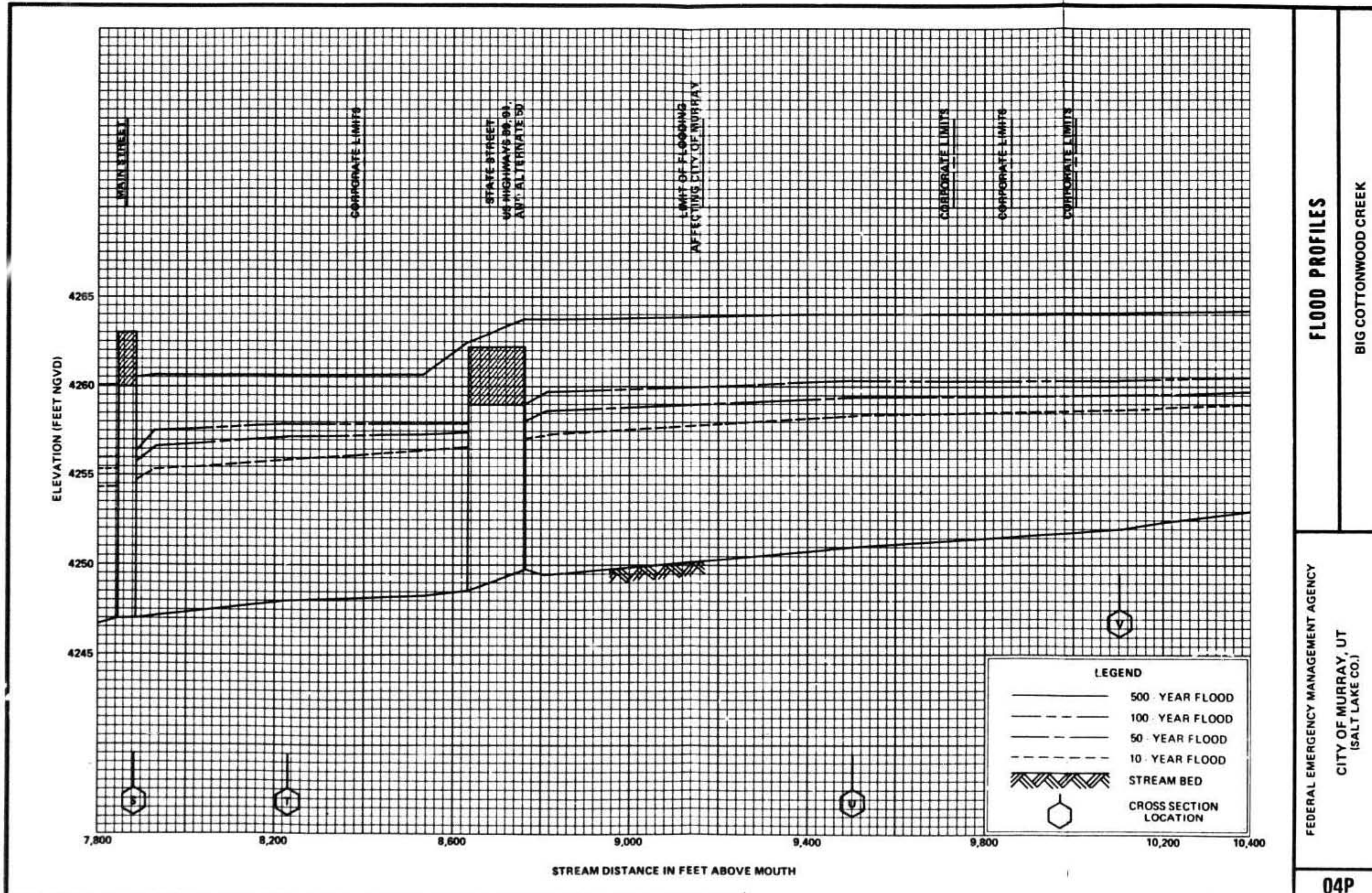
FLOOD PROFILES

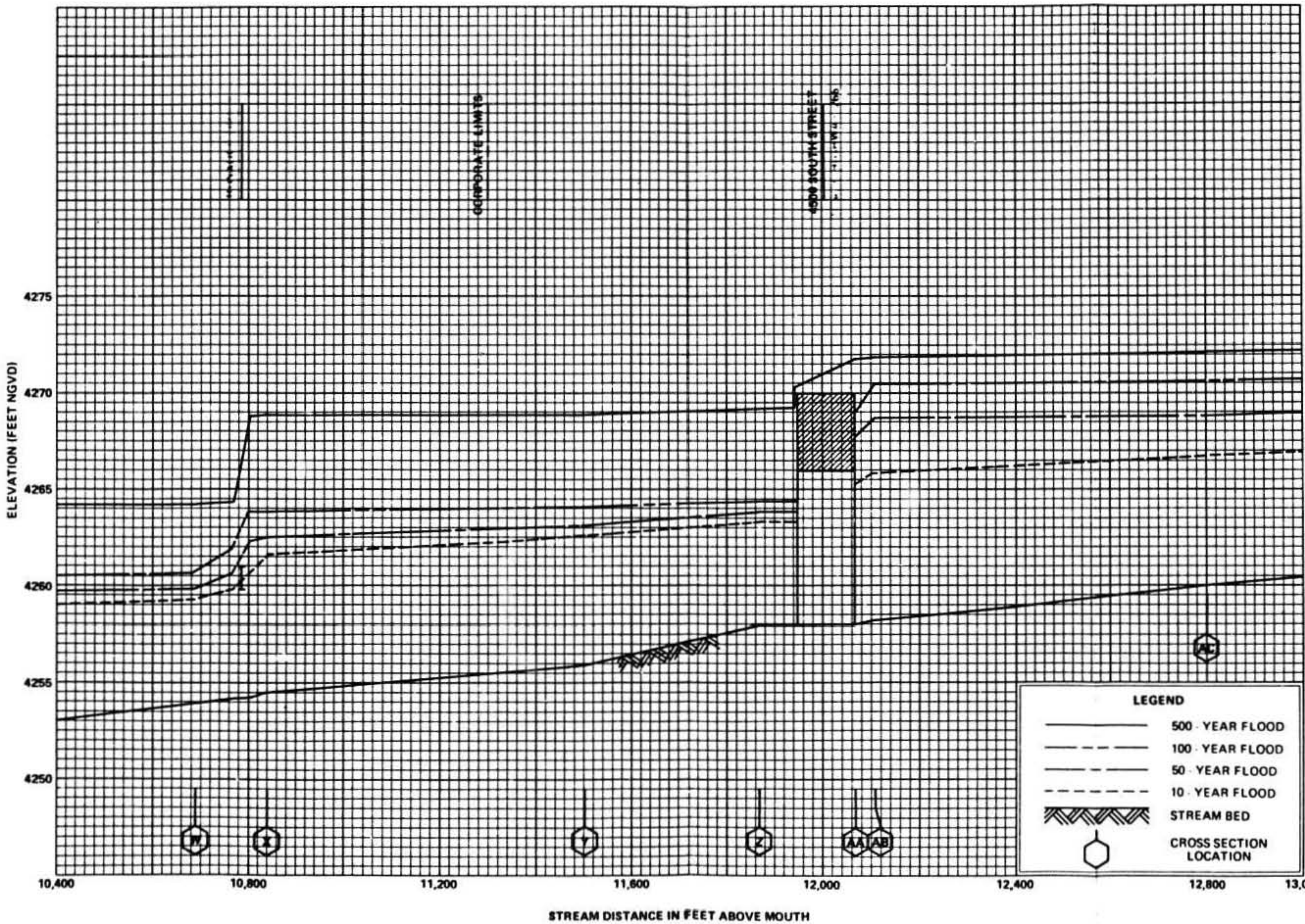
BIG COTTONWOOD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MURRAY, UT
(SALT LAKE CO.)

03P


MAIN STREET
CORPORATE LIMITS
STATE STREET
US HIGHWAYS 89, 91, AND ALTERNATE 50
LIMIT OF FLOODING AFFECTING CITY OF MURRAY
CORPORATE LIMITS
CORPORATE LIMITS
CORPORATE LIMITS
ELEVATION (FEET NGVD)
4265
4260
4255
4250
4245
LEGEND
500 - YEAR FLOOD
100 - YEAR FLOOD
50 - YEAR FLOOD
10 - YEAR FLOOD
STREAM BED
CROSS SECTION LOCATION
S
T
U
V
7,800
8,200
8,600
9,000
9,400
9,800
10,200
10,400
STREAM DISTANCE IN FEET ABOVE MOUTH
FLOOD PROFILES
BIG COTTONWOOD CREEK
FEDERAL EMERGENCY MANAGEMENT AGENCY
CITY OF MURRAY, UT
(SALT LAKE CO.)
04P



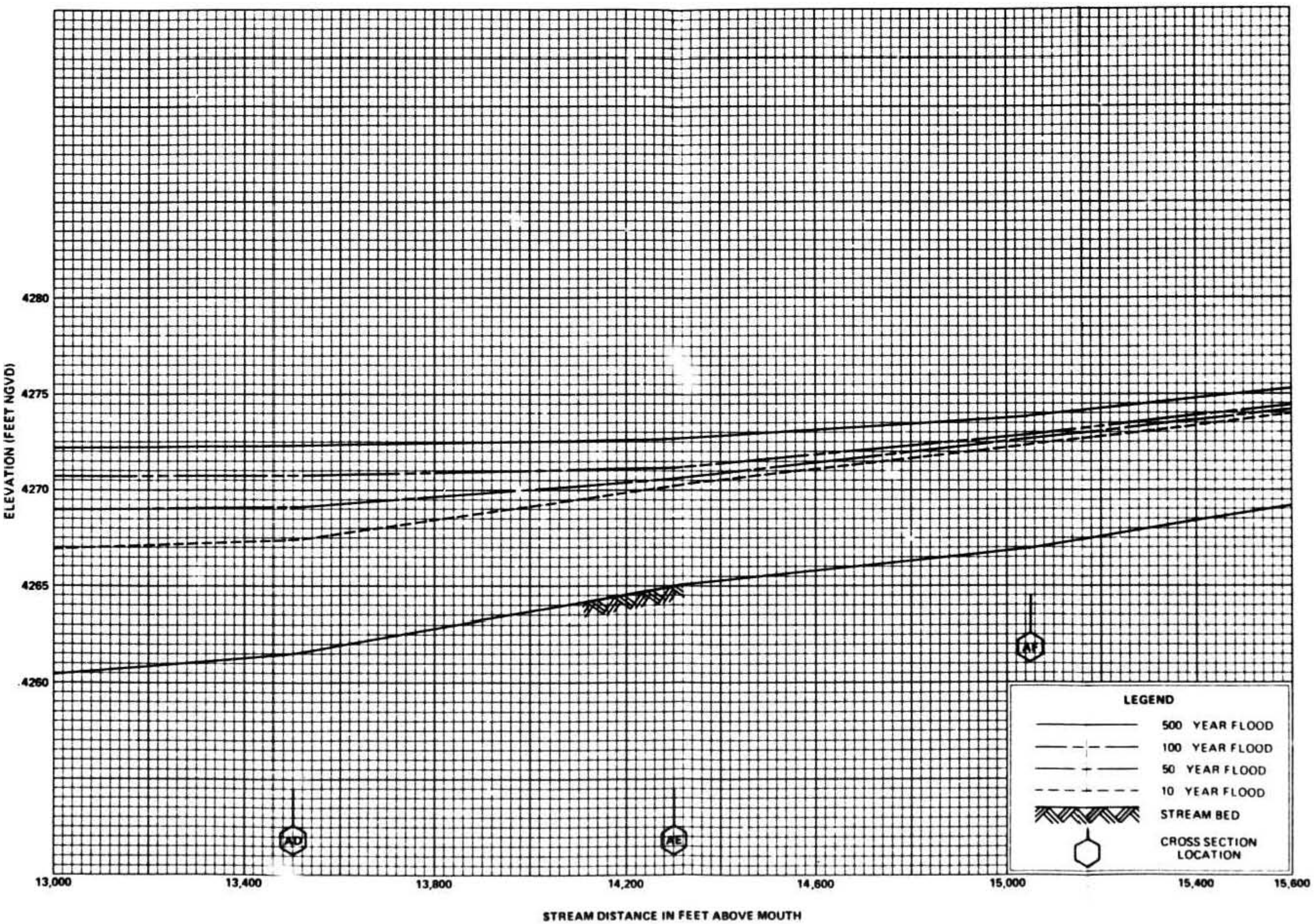
FLOOD PROFILES

BIG COTTONWOOD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MURRAY, UT
(SALT LAKE CO.)

05P



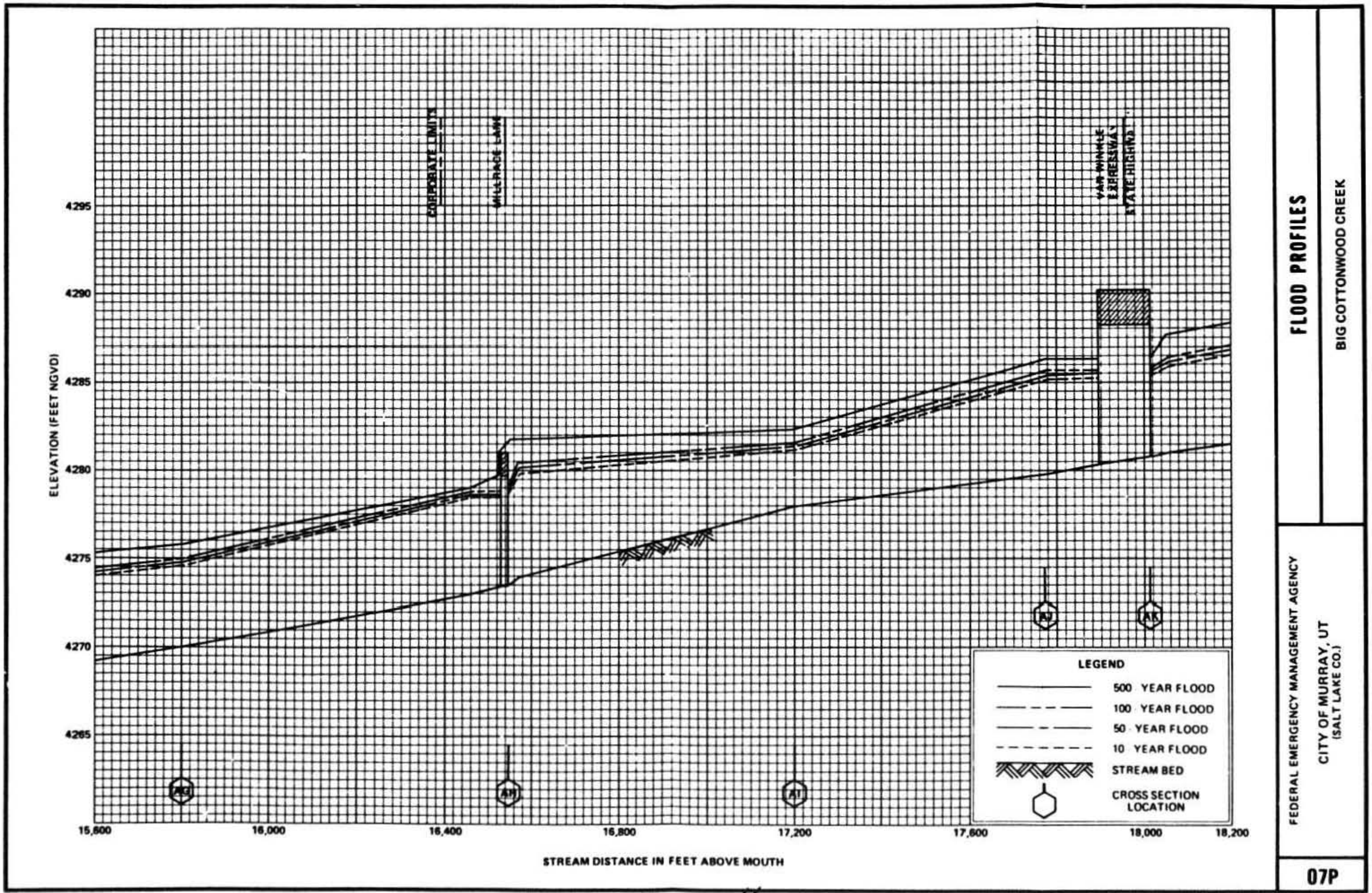
FLOOD PROFILES

BIG COTTONWOOD CREEK

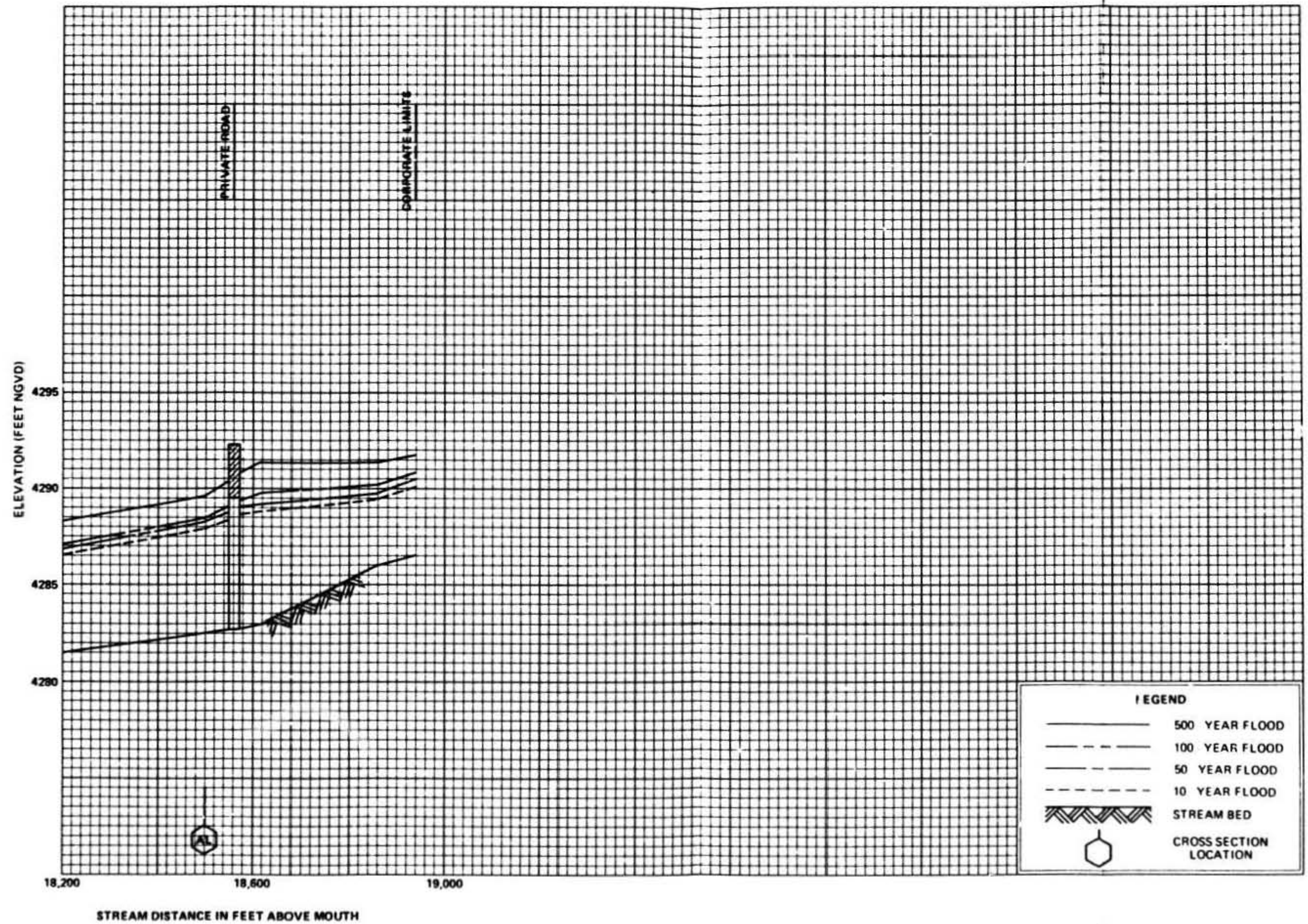
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MURRAY, UT
(SALT LAKE CO.)

06P


CORPORATE LIMITS
MILLRACE LANE
VAN WINKLE EXPRESSWAY
STATE HIGHWAY
ELEVATION (FEET NGVD)
4295
4290
4285
4280
4275
4270
4265
AG
AH
AI
AJ
AK
15,800
16,000
16,400
16,800
17,200
17,600
18,000
18,200
STREAM DISTANCE IN FEET ABOVE MOUTH
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
STREAM BED
CROSS SECTION LOCATION
FLOOD PROFILES
BIG COTTONWOOD CREEK
FEDERAL EMERGENCY MANAGEMENT AGENCY
CITY OF MURRAY, UT
(SALT LAKE CO.)
07P

43



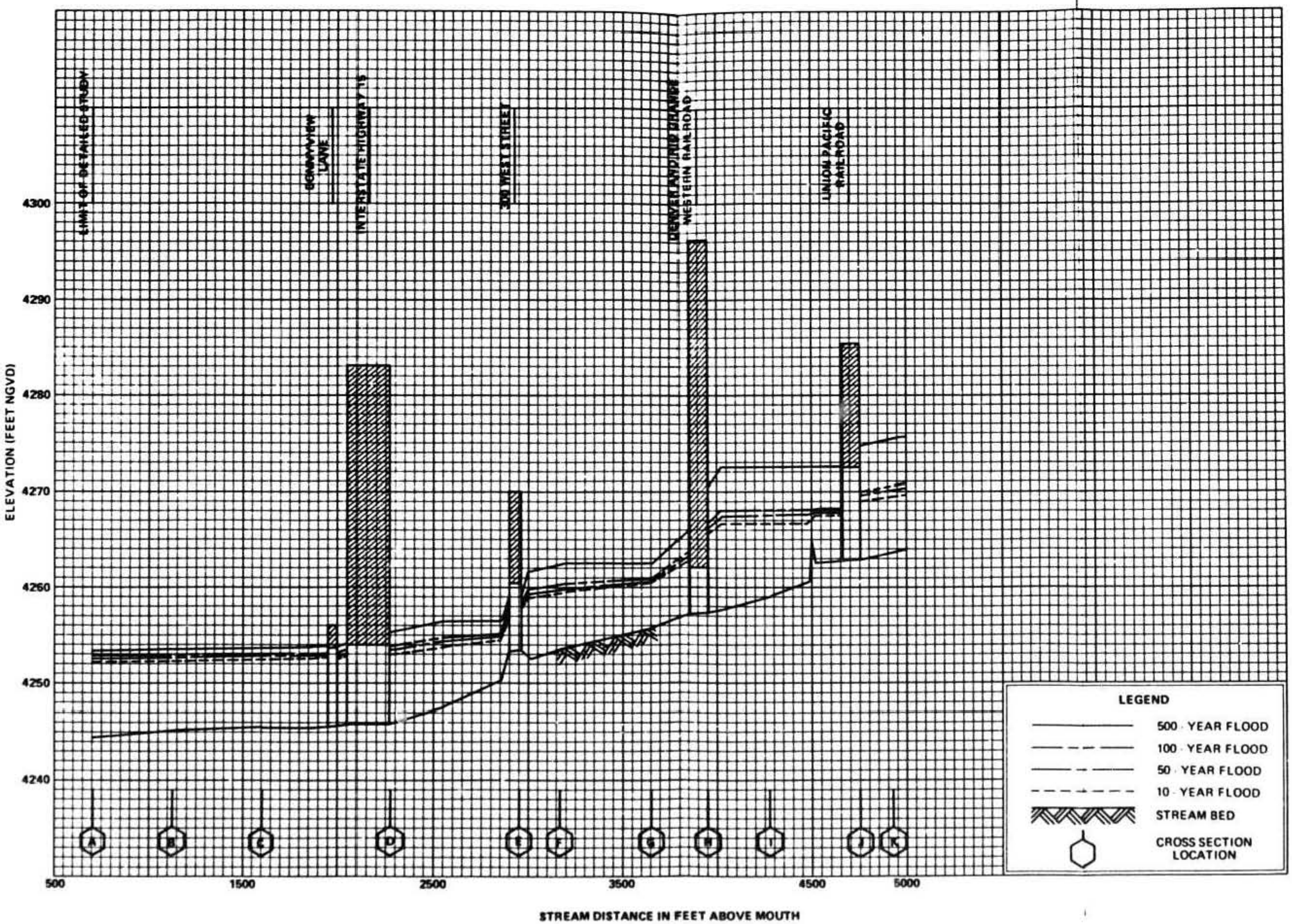
FLOOD PROFILES

BIG COTTONWOOD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MURRAY, UT
(SALT LAKE CO.)

08P



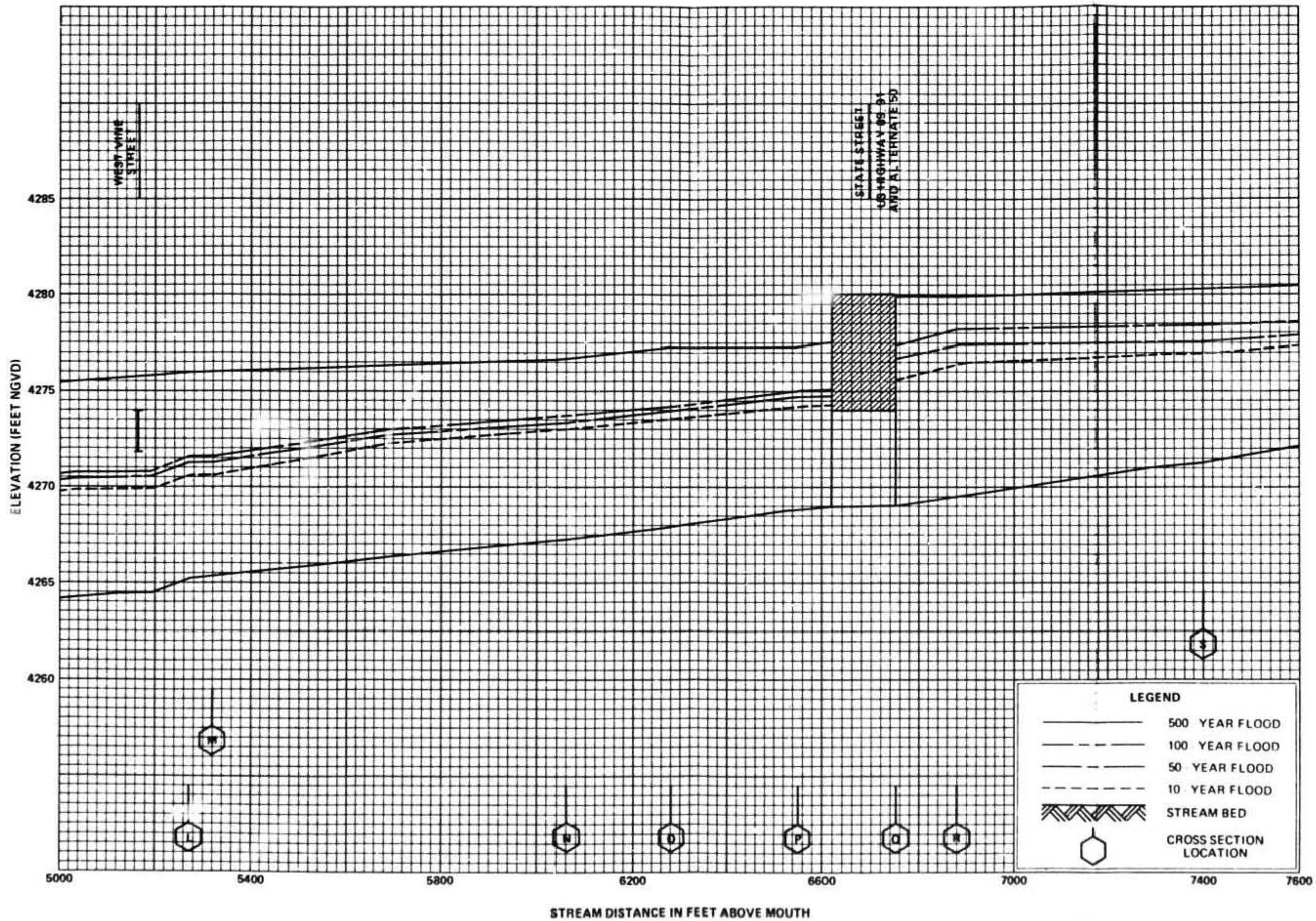
FLOOD PROFILES

LITTLE COTTONWOOD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MURRAY, UT
(SALT LAKE CO.)

09P



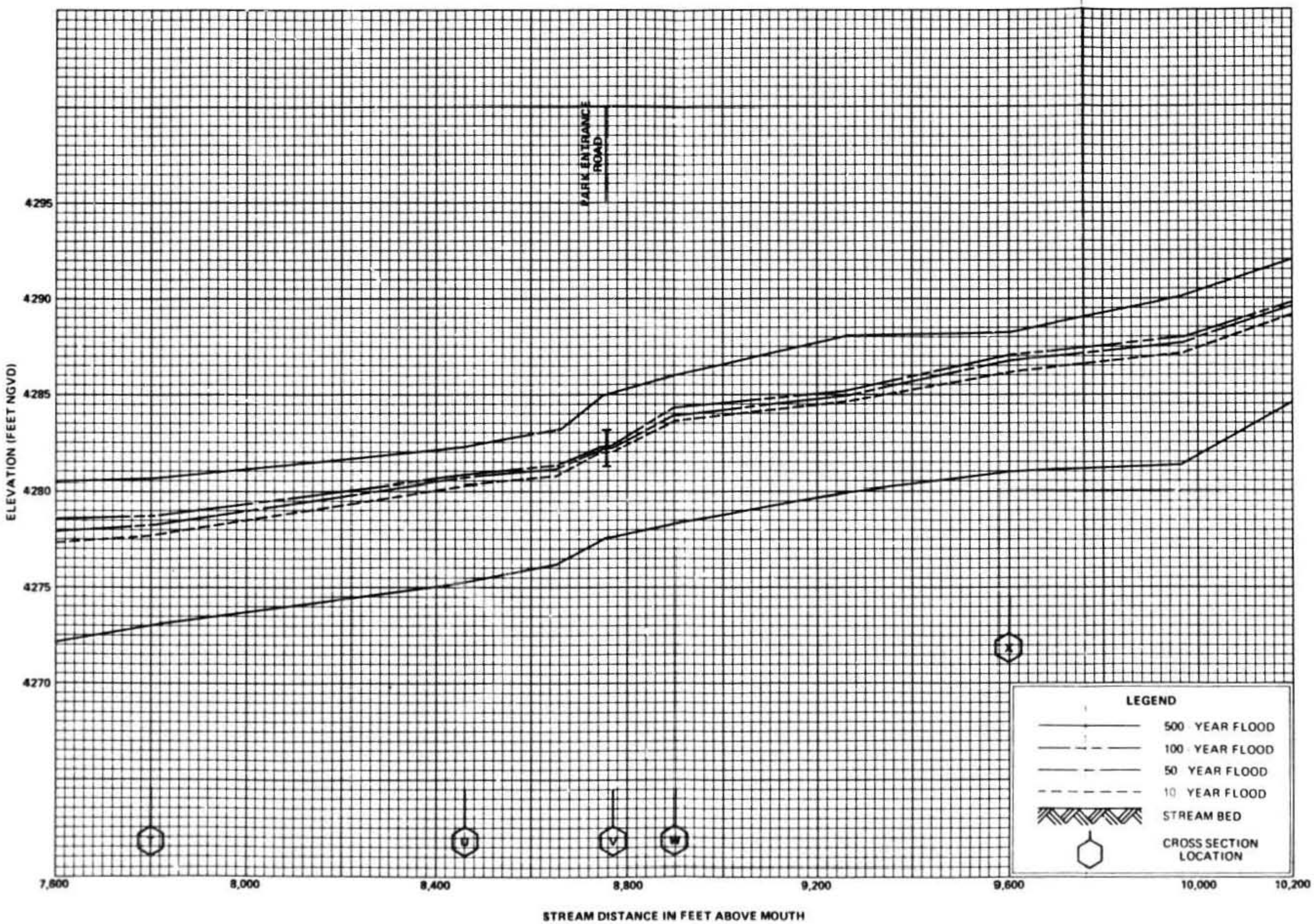
FLOOD PROFILES

LITTLE COTTONWOOD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MURRAY, UT
(SALT LAKE CO.)

10P



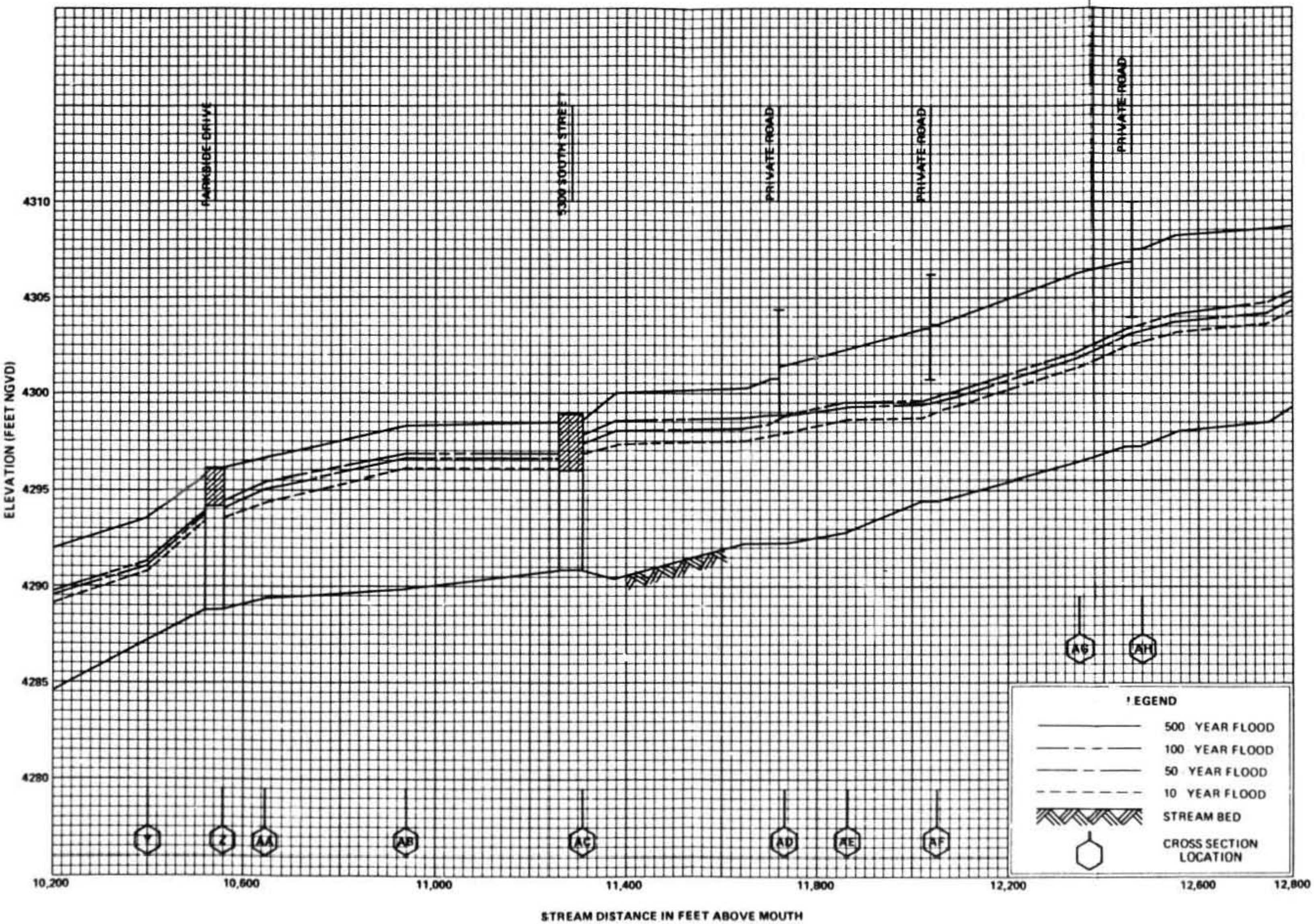
FLOOD PROFILES

LITTLE COTTONWOOD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MURRAY, UT
(SALT LAKE CO.)

11P



FLOOD PROFILES

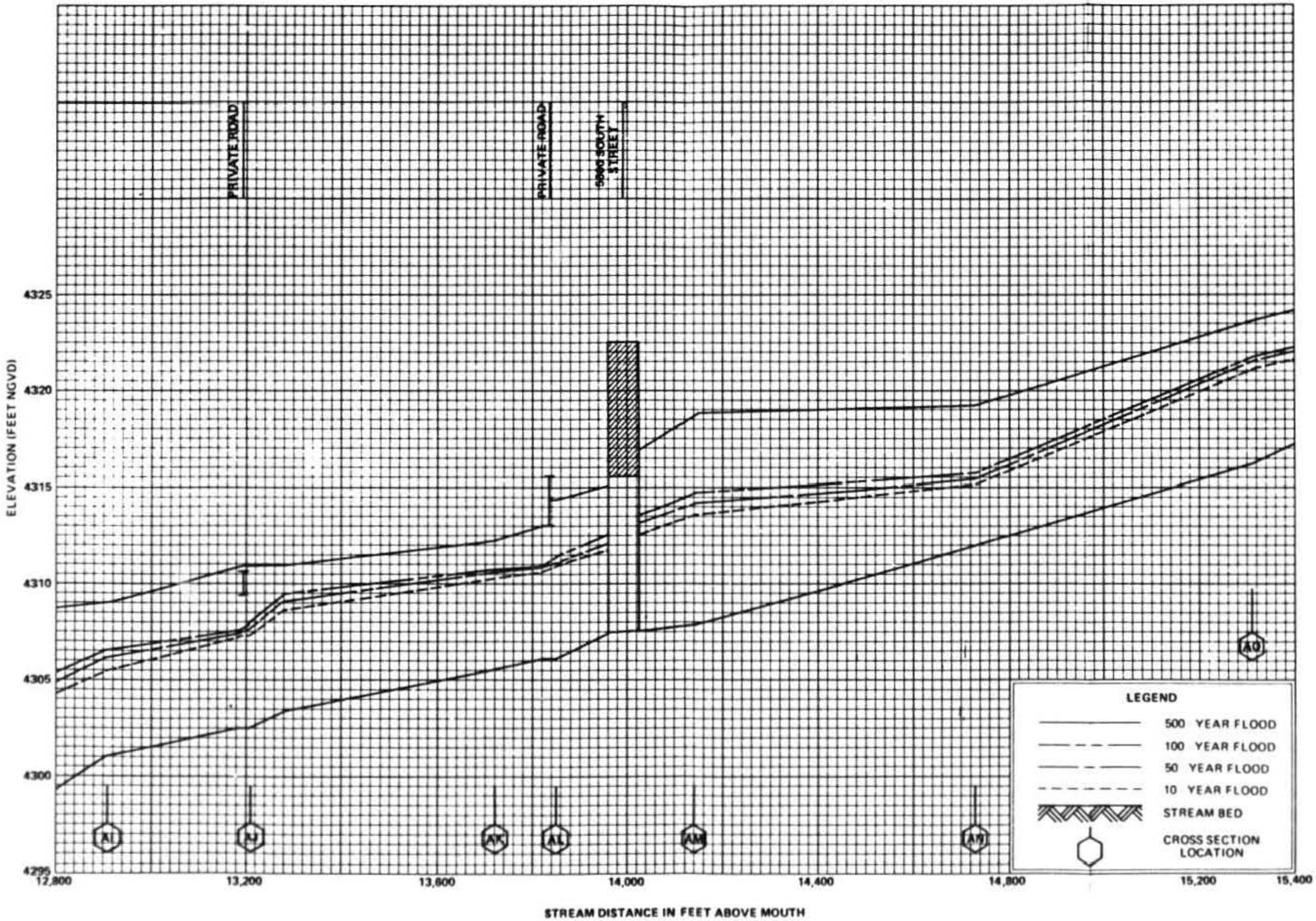
LITTLE COTTONWOOD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MURRAY, UT
(SALT LAKE CO.)

12P

48



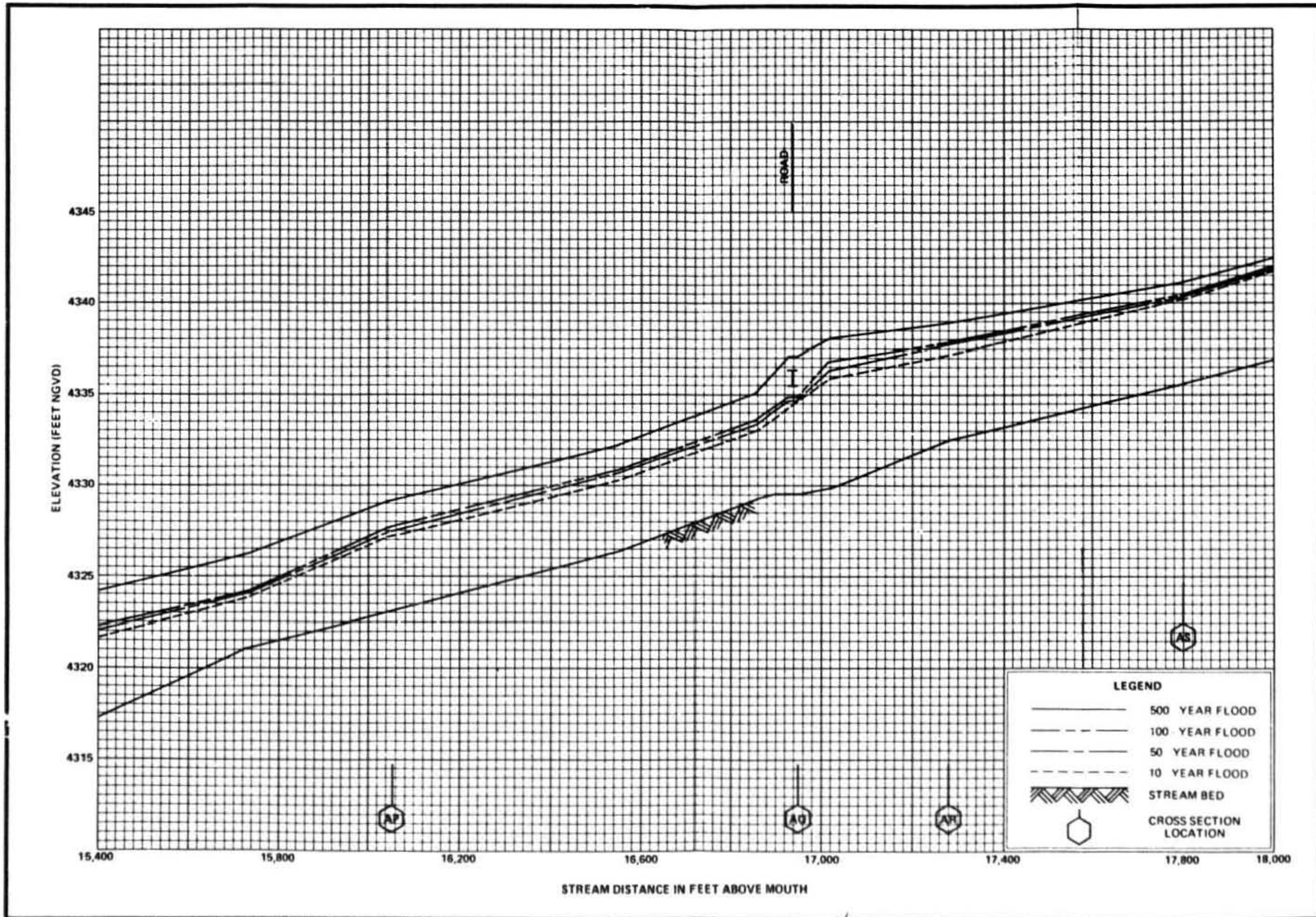
FLOOD PROFILES

LITTLE COTTONWOOD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MURRAY, UT
(SALT LAKE CO.)

13P



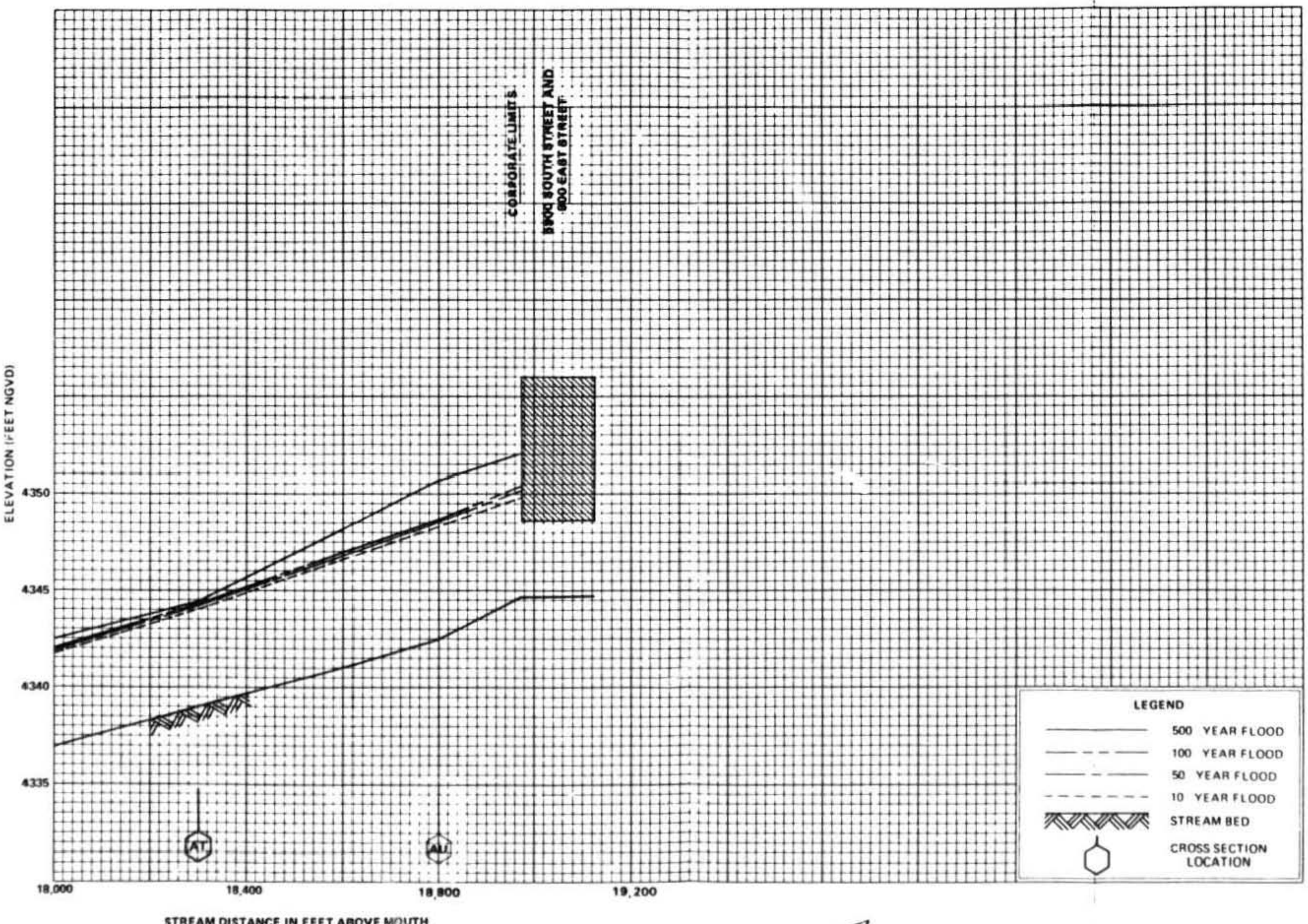
FLOOD PROFILES

LITTLE COTTONWOOD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MURRAY, UT
(SALT LAKE CO.)

14P



57

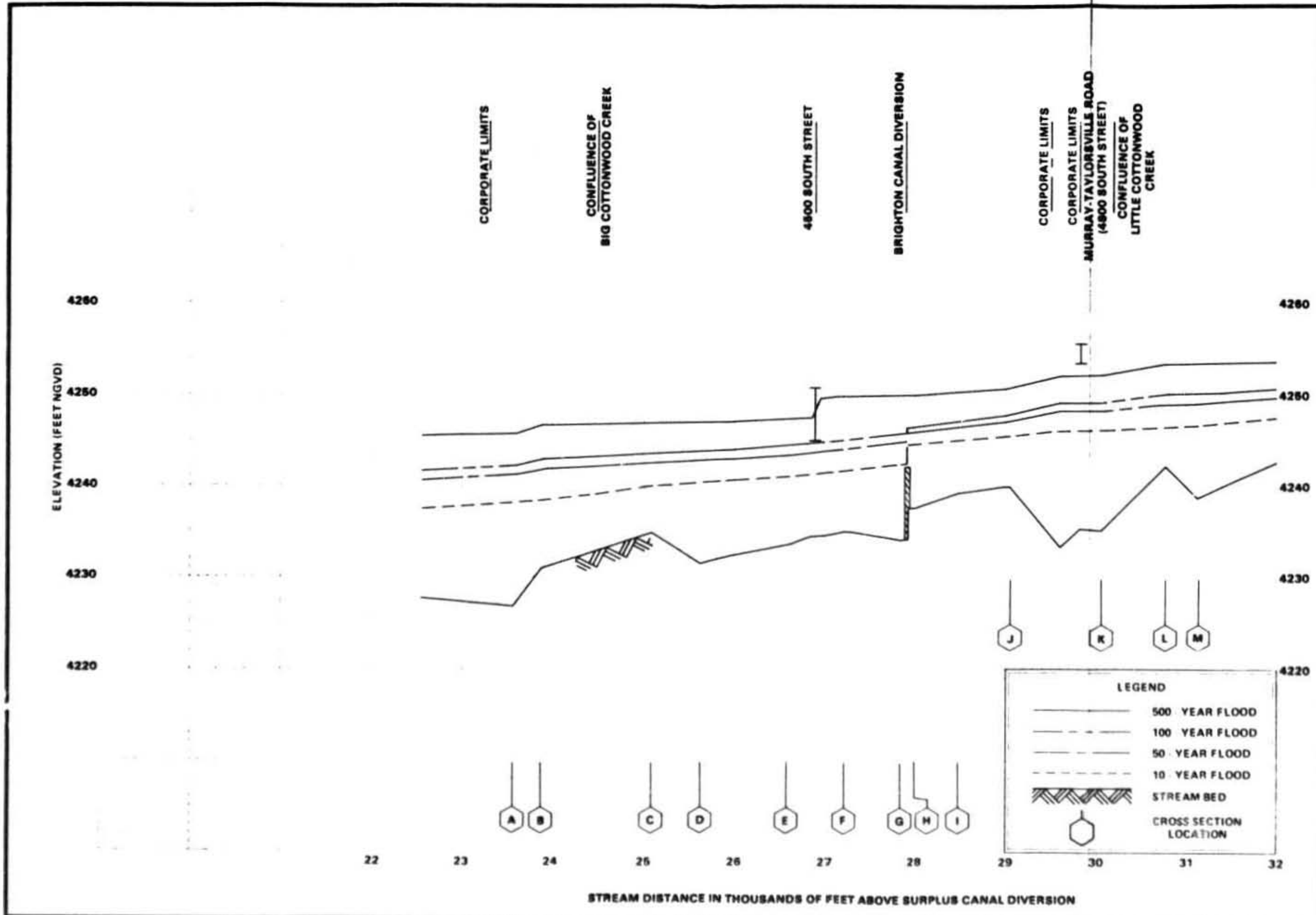
FLOOD PROFILES

LITTLE COTTONWOOD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MURRAY, UT
(SALT LAKE CO.)

15P



FLOOD PROFILES

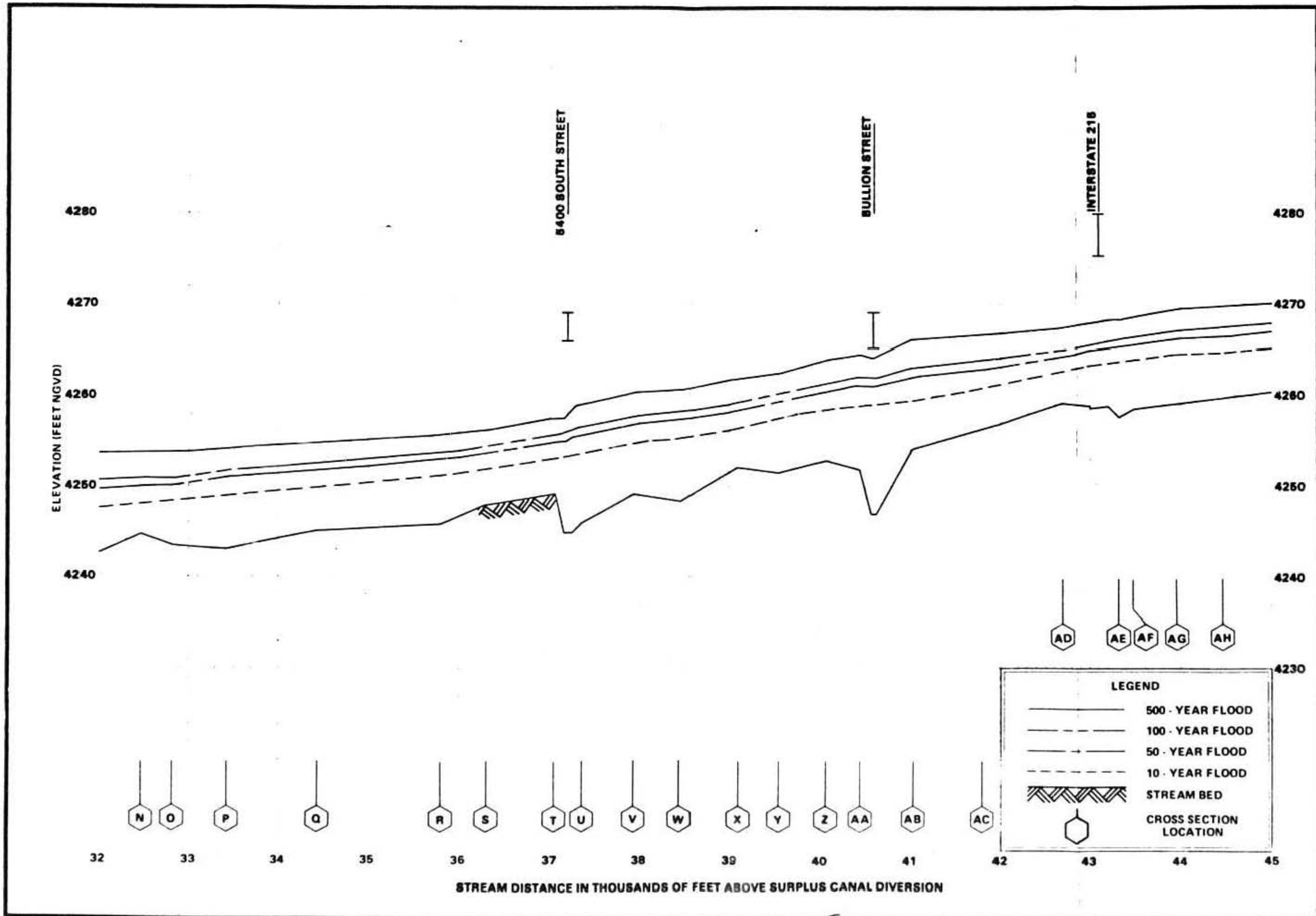
JORDAN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MURRAY, UT

(SALT LAKE CO.)

16P



FLOOD PROFILES

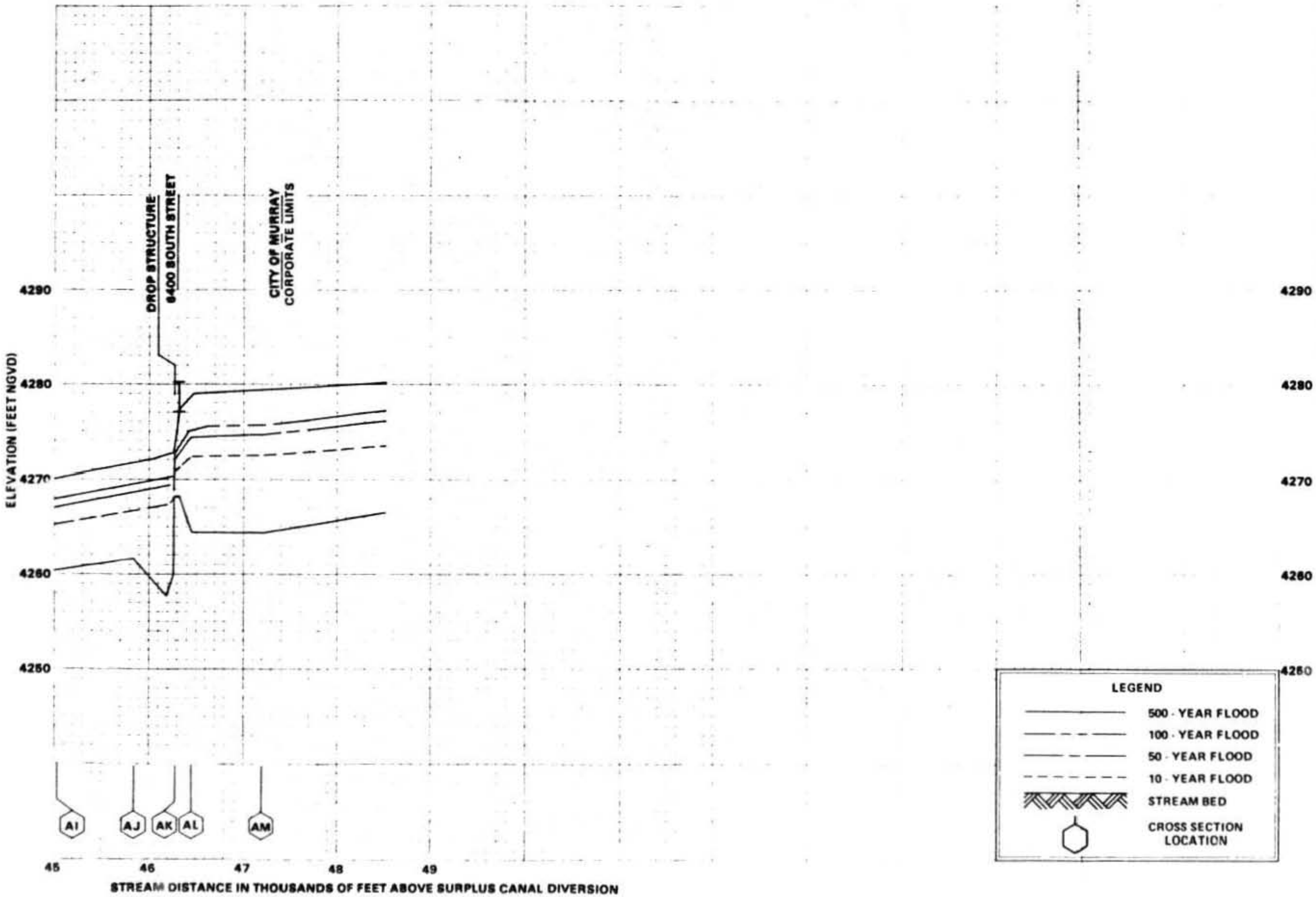
JORDAN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MURRAY, UT

(SALT LAKE CO.)

17P



FLOOD PROFILES

JORDAN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MURRAY, UT
(SALT LAKE CO.)

18P

54